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ORIGIN AND DESCENT OF THE HUMAN BRAIN.[1]

BY S. V. CLEVENGER, M.D.

THE object of this paper is to present to comparative anatomists certain aspects in the phylogenesis of the spinal cord, which culminate in the development of the brain of man.

The word brain is here used to include only the nerves and ganglia of the skull. The term has been applied so loosely that Professor Wilder rightly advises its discontinuance from neurological nomenclature.

Briefly stated, the nerves interrelate the muscles as the muscles interrelate the bones, nerves further are internuncial in conveying external or internal molecular vibrations to irritable or contractile tissues.

Biological investigations enable us to approach very closely the border land of sensation and molecular physics. While the physicist is striving to reduce his laws of sound, heat, light, electricity and gravitation to their ultimates, the biologist is meeting him over consideration of the forces which control the motions of the Amœba or evolve the animal from the cell.

In the Journal of the Royal Microscopical Society (Vol. III, No. 1, p. 63, from Arch. Mikr. Anat., XVII, 1879, p. 58) are diagrams of the simplest acoustic and visual cells. These forms of nerve cells proceed from a still simpler protoplasmic cell, which, according to situation or the influences brought to bear upon it,

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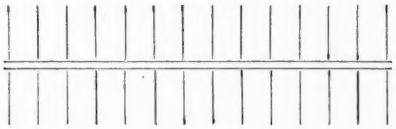
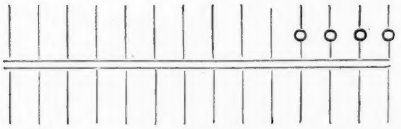
can as well develop into muscle, cartilage, cuticle or bone. It is the position of the cell and its environment which in embryology, as well as in phylogeny, determines what the cell shall become. The unity of the forces at work in nature are very evident to the biologist as well as to the physicist. But we must pass on to the main subject with the statement that after an orderly method of aggregation, certain protoplasmic cells arrange themselves along the dorsum of the embryo in the egg, and a spinal cord is formed.

The simplest spinal cord is owned by the Amphioxus, a vertebrate lower than the lamprey of our lakes. This fish-like animal has no brain. Extended the length of the body, is the cord, and nerves enter it dorsally and ventrally; the second pair of nerves of the head end pass caudally. Those along the back in this diagram are sensory, the lowermost being motor:



Owen compares these longer nerves to the nervus lateralis of the cod. He mentions them also as nerves of association comparable to the trigeminal and vagal.

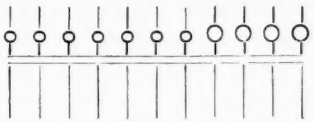
The cord of the lamprey *(Petromyzon fluviatilis)* is quite rudimentary, but a distinct brain presents itself in this case for analysis. We find certain intumescences attached to the spinal cord at the head end, which can be represented schematically thus:



The real appearance of these ganglionic swellings, for such they are, resembles the embryonic fusion of cerebral and spinal ganglia. A very important revelation concerning the homologies of these tubercles, I hope to be able to present to the next meeting of the American Neurological Society.

Notice that in this low vertebrate form, these enlargements on the sensory or ingoing nerves, occur at the head.

A Teliost, the *Trigla adriatica*, affords an example of these same enlargements appearing all along the spinal column:



(The *lateral* fusion also between these ganglia in the head end, occurs among the intervertebral in *Orthogoriscus mola*.)

Taking a general survey of the piscine and amphibian brains, we find, in many, these ganglia well defined as rounded, symmetrically placed bodies (Lepidosteus, Amblyopsis, Leuciscus), while in others these lobes are distorted, by elongation or cramping, in all directions (sturgeon, chimæra, sharks), and in still others, some of the lobes are pushed below the usual site (cod, herring, perch). Of necessity the ventricles must often be partially or wholly obliterated, showing the inexpediency of making use of ventricular passages in homologizing.

This crowding together, fusion and distortion of ganglionic lobes, obtains throughout animal life, and the olfactory lobe is often so closely fused with the prosencephalon as to afford us no line of separation. An interesting point in this connection is presented by the corpora bigemina, which lie upon the upper surface of the brain in reptiles, being succeeded in birds by these bodies being thrown down to the sides and base of the brain, crowded there by the greater relative size of the superior lobes.

The intervertebral ganglia which develop on the afferent nerves of the higher vetebrates undergo great development within the cranium, and by lateral crowding together, the median line of separation is obliterated, giving us the large central lobe of the shark and birds. Two or more of these ganglia may develop upon the same sensory strand (see Davida, *Centralblatt*, No. 26). The subsequent lateral lobes of the cerebellum can be resolved either into secondary or primary ganglia, or a mixture of both, certainly the vagus tubercle of the fox shark is in all essentials the pneumogastric lobule of man's cerebellum, the flocculus.

Thus it appears that by the pressure together of a number of these posterior spinal nerve root swellings a cerebellum has been formed. The cerebellum is now generally conceded to be a coördinator of sensation for cranial sensory nerves, and how can it be otherwise from this view? By this coalescence of interverte-

bral bodies it necessarily follows that sensations passing in from a variety of points must be distributed to a wider area of central points in the medulla and spinal cord. This explains why injury to the lateral lobes may occur without manifestation of the lesion and why a disorder of the central lobe or vermis produces a staggering gait. The main bundles of ingoing nerves are gathered in the latter region, while the plexus of fibers in the lateral lobes afford many avenues for impulse passage, other than those injured or destroyed. The original globular appearance of the lobes composing the cerebellum may be well made out in most quadrupedal forms, but as we pass to man we see that these lobes have become compressed into laminæ.

In a previous paper (presented to the American Association for the Advancement of Science, Boston, August 28, 1880, published in the *Journal of Nervous and Mental Disease*, October, 1880, and AMERICAN NATURALIST, January and February, 1881), I endeavored to show that all tubercles of the vertebrate brain fall within this category of intervertebral, a notable instance being the Gasserian ganglion. Mr. A. Milnes Marshall (*Monthly Microscopical Journal*, London, October, 1877), in an article "On the development of the nerves of the chick," shows plainly that the olfactory nerve must be considered homologous with spinal nerves, for it is similarly developed and in no way differs from a spinal nerve. Nor does the comparison rest here, for the lobe (not bulb) of the mammalian olfactory may be seen to be developed between the central tubular gray and the periphery just as is an invertebral. As to internal structure, the law of differentiation shows that subsequently acquired differences are not arguments against original derivation, for what can be more unlike than bone and cartilage, skull and vertebræ or hand and foot? And yet the one is a developed or differentiated condition of the other.

Thus the mammillary eminences, the epiphysis, the optic and post-optic lobes were originally intervertebral, and the olivary body embedded in the spinal gray is another related particularly to innervation of the tongue. It is very large in the parrot and has relation to the ability of that bird to articulate. But the most general interest centers in this large mass of nerve fibers and cells called the cerebrum. In the Ornithorynchus, it is smooth and simple in form, but the beaver also has an unconvoluted brain,

which shows at once the folly of attaching psychological importance to the number and intricacy of folds in animal brains. With phrenology, which finds bibativeness in the mastoid process of the temporal bone and amativeness in the occipital ridge, the convolutional controversies must die out, as has the old so-called science of palmistry, which read one's fate and fortune in the skin-folds of the hand.

The most noticeable change in form, as we pass up the scale of mammalian life, occurs in the production of the fissure of Sylvius. In most quadrupeds the olfactory lobe fills up largely the anterior part of the cranium. As the smelling sense diminishes this lobe degenerates to a mere tract and the frontal lobe of the brain increases in size, lifting the forehead into a vertical plane. The medulla is pushed forward to a less oblique angle with the front of the brain, from Lemuridæ to chimpanzee and man, and the frontal lobe pressure covers the cerebellum with the backward progress of occipital, till finally the occipital forms the temporal by curling under and forwards, forming the Sylvian fissure. These stages of progress are evident in the horse, elephant and human embryo. Often, in idiots, we find through want of development of this frontal lobe, that ossification takes place in a plane inclined at an angle corresponding with that of lower animals, and the cerebellum is uncovered. This is an adaptation of the skull to its contents, which, however, does not always take place. There are other elements at work to cause the skull to develop normally or even enlarge it abnormally, as for example, an accumulation of water in the ventricles will change the relative positions of the cranial bones to such an extent as to give to the hydrocephalic idiot the "front of Jove."

While the ontogenetic stages of development resemble strikingly the forms mentioned by Haeckel, the nervous system is not apparent in the embryo until we reach the ninth stage or Acranial, after this the cerebral vesicles rapidly develop and resemble in general the Cyclostome stage, and just as the sharks and mud fishes possess the intervertebral ganglia, which the hags and lampreys have not, the human fœtus, subsequent to the shaping of the cerebral vesicles, develops the posterior spinal nerve root swellings. From this point upward, it is easy enough to observe, that like the brains of marsupial adults, the cerebellum is at first uncovered, then by frontal lobe growth the temporal lobe is formed as in Simiadæ.

THE EASTERN SNOW-BIRD.

BY REV. SAMUEL LOCKWOOD, PH.D.

FOR New Jersey, so severe was last winter, that appeal is made to "the oldest inhabitant" to adduce a similar experience. As is usual with this mythical "Old Prob.," he fails to cite an instance. Albeit the pure white of her "wrap," nature in her snowy deshabille is not altogether lovely. In truth, many of her admirers, with a shiver, withdraw from their open-air converse to a fire-side communion. It is all very well to talk of coasting and skating, and to get into high jinks about "the tintinnabulation of the bells," meaning that excruciating jangle, yclept "sleigh music," which has no music in it, unless we thus dignify the sonorously uproarious "gling! glang! glorious!" of that Teuton, Hans Breitmann. It may be as a dull man we prefer a toot on a gentler even if sadder strain. Leaving out the pangs of poverty, what shall be said of the keen suffering attendant on out-of-door industry, when exposure is so pitiless on man and beast! And yet this general nudeness is not without advantage of a weird sort to the true naturalist, because of a certain transparency which whets the faculties, imparting edge to curiosity and precision to observation. All things seem open. The very atmosphere is in sympathy with the naked truth—and even the trees, from bole to spray, become on a sudden crystalline. The sight is sharper and the hearing keener, and both are farther reaching. Last Lord's Day morning, January 30th, the air was pure, bright and still, and the timbre of our village church bells seemed peculiarly fresh, as they pealed forth the hebdomadal summons in the pure frosty breath of their brazen throats. Though walking briskly, the church-goer looked more thoughtful. He felt himself possessed of an almost mysterious enlargement and refinement of the senses; for he heard with startling distinctness the church bell of a hamlet fully five miles away to the east, and with equal clearness his ears took in the sound of another church bell from a village as far away to the west. It was observable, too, that both rang in the same tone—but that the ringing at the east was set eight notes, or a full octave higher, than that at the west. Did the one think herself eight strides the nearer to churchly perfection? But fie! Why seek to revive a point so mooted by the oriental and occidental churches?

But how obliging has nature become, that she allows a convalescent to interview her from his study windows. Yes, and her coyness breaks down too, for she lets out some of the esoteric ways of her winter birds. After falling many hours, the snow stops, and a cold clear blue sky opens over head. A flock of snow-birds has come. They seem to be the living feathery fringe on the skirts of the snow storm. And what a relief these pretty birds impart. This nival covering is not a shroud to conceal the dead, but a warm comforter spread over earth's slumbering forces by that Great, Good Hand "which giveth snow like wool." In easy view from my library windows is a spot in the headland of the old orchard, where last autumn grew a tall *Phytolacca decandra*. The tip of the dead plant is but just exposed, and that is hint enough to the little fellows that the dried currant-like berries of the pokewort are to be found in a natural cache under the snow. The way in which a group of five or six birds keep at the spot would indicate that the placer "pans out well." How they do dig down into the snow! Dig? Yes, though, very un-bird-like, that is the right word, for it is altogether unlike scratching. Its method of mining, for a bird, seems to me to be original. Our *Junco hyemalis* is a hopper, not a runner, and scratching is, as a rule, not an accomplishment of the hopper family. In truth, you can't bring the hoppers up to the scratch any way. Still our snow-bird is great on push—he does shove things; and a queer shove it is. I am almost afraid to attempt a description. The bird stiffens out its toes, then makes a jumping shove forward and upward, thus lifting and flirting the snow. The movement is of the whole body, and the action is scooping, not unlike that of a ditcher. It is not a shuffling motion, for it demands too much dexterity, but a true shoveling movement. Like the post-hole digger's shovel with its short blade and long handle, the middle toe of Junco is shorter than its tarsus.

Soon this natural cache was exhausted, and a deep, wide excavation with a small entrance was the result of their patient digging. It was truly a snow cavern. The birds soon learned to feed from a supply put at their service on the window sill. Finding so good a commissariat, they sojourned with us a number of days, the little bevy of not more than seven, keeping always together, as if by a family compact. Indeed, this is a pretty domestic feature of our eastern snow-bird. Some twenty-five feet from

our study windows is a beautiful copse of *Thuja occidentalis*, or arbor vitæ, its object being to screen an outhouse from the public road. The trees are high and the foliage dense, and each tree hugs its companion lovingly, so that all seem but as one. Hither come our little birds when the day's foraging is done—this is their nightly "covert from storm and rain;" while strange to tell, their snow dug-out is made to serve as a cosy asylum from the cutting wind by day. A callow philosopher to whom the above was mentioned, pronounced it a probable instance of mimicry inherited from a very ancient Junco, who got the idea from that glacial Eskimo who made snow dug-outs in Central New Jersey. The suggestion was declined, with thanks, but our speculative friend seemed much graveled about it. Nor did the counter suggestion mollify matters—that snow-house building required some architectural skill. We even urged the fact of its form, a segment of a sphere, and further that as a true surbased dome, this igloo of these Innuits greatly antedated that famous dome of the Parthenon, yet were less ancient than the dug-out domiciles made by mollusks, insects, birds and beasts.

There are always to be found the ne'er-do-wells among both birds and men. The survivals generally are such as anticipate the untoward times. We hear of the imported sparrows stuffing their boxes to exclude the cold; and we saw in an elm tree in the village, a nest which they had made of coarse materials, almost large enough for a hawk, the simple carrying labor for which must have been prodigious. But among these little folks, this providing for a rainy day is exceptional. It does not indicate the tribal habit so much as the individual capacity. I did not see any other Juncos improvise a snow dug-out into a shelter from the storm. With many birds it is a common practice to avail themselves of the handiwork of man. My daily paper reads: "During the recent cold weather a flock of snow-birds took refuge from the cold in Margaret English's barn at Smith's Landing, and became very tame." We trust that the good Madam, like a pearl of a woman, gave the wee birdies food. "Became very tame." This tail end of that local item wags more gravely than the writer knew. This tameness of the snow-bird is only in winter born, and comes of pitiless pinching pain. The food supply withdrawn they come timidly to our doors. And how delightful it is that one may turn his window sill into an almonry for the

winter birds—to us and them, so much happiness at such small cost. What goes on in these little birdies' brains, we may not find out; yet it would be just nice to know if gratitude were there, and maybe homage too; and if they looked to us as being unto them their Great, and Good, and Bountiful. Well, all this is the poor man's privilege, despite that greed of opulence:

"Whose talons grasp the blessings of the world."

Our eastern snow-bird does not hold together long in large flocks, but does like to keep together in small bevies, or family groups. Whatever it is, whether conjugal, parental or filial, or all combined—there certainly is affection:

"Oh, love is sweet through all the busy day-time;
Oh, love is true in winter and in May-time!"

The group I am interviewing numbers seven individuals; whether they are blood-kin I cannot affirm, but I adopt the hypothesis and feed them as a necessitous family. But see! Is a good deed contagious? These tiny things have caught the knack of charity among themselves! There is a poor little snow-bird on a rail; something ails it, for a stalwart Junco is carrying food and feeding it with nursely tenderness. To and fro goes the noble little fellow, until the hunger of its nursling is appeased. The bird is in some way lame of wing; and its benefactor knows all about it. But this in a little birdie's noddle, is a good deal; for a double question is under consideration, namely, hunger and safety, demanding foresight and strategy. If it would, the crippled bird could go to the window sill and help itself; for it has managed to keep up with the family flock, but with painful effort. These two words lighten up the whole case. Even the stalwarts come to the place of feeding not without circumspection and some distrust, being very watchful for grimalkin and every other danger; hence this thoughtful commiseration—that crippled bird must be allowed a position "surveying vantage." We have it from the professional bird trapper, that "snow-birds are not easy to catch."

Our *Junco hyemalis* has some really good qualities; he is social, and can be generous on occasion, and if clannish he is at least peaceably minded in his own family circle; with encouragement, I think the trick of familiarity would grow upon him, and he might become a welcome window bird in winter, like the English redbreast, sitting on the sill and pecking at the pane.

Although farther on I may have, for the sake of truth, to mention an instance, far from commendable, of Junco's ill conduct in the company of his "betters." As a cage bird he is cheerful, and generally bears a good reputation; he is reported to us, however, as impatient of restraint when the warm season comes; and I think that I have seen his best qualities in his winter freedom. He is winsome, and has a trace of humor—an unconscious serenity of the Mark Tapley order—for let the clime be almost Arctic, so but the rations hold out, he is gay and wide-awake; his plumage, too, is that of a well conditioned bird—so trim and smooth and bright. But here comes one of those proletarian summer bickerers—he of the bad reputation—"who killed Cock Robin." Poor sparrow! I do feel for him, with his fluffy outspread like a little impish owl, which "for all his feathers is acold." He moves squattingly, so as to hug his frozen toes. The snow-birds let him to their store and welcome; having fed well, they feel too good to be malevolent, and are enjoying a sort of pop-game, hopping in and out of their snow dug-out. But whom have we here? The Carolina wax-wing, close cousin to that big Bohemian; he is the only one of his tribe that has been along this winter; despite a trace of the stuck-up, there is something almost ducal in his coronal uprightness; nor is he at all crestfallen at the unwonted inclemency; in fact he is rather majestical in a toploftical way, and deigns, through a two minutes' patronage, to look at the snow-birds' frolic, and then leaves. A very practical fellow now appears in the apple tree near my window, the hairy woodpecker, and he begins business at once, pegging in for dear life after that larval Saperda. How he makes the chips fly, and breaks the cold stillness with his rat-ta tat-tat. All these are living episodes. But that poor moribund sparrow, he is so forlorn; and well he may be, for my boy reports that several of his fellows have just succumbed to the pitiless cold, and are lying stark-stiff in the barnyard. The truth told, the winter is exceptionally severe; reports from over thirty observers in our county declare that two-thirds of the quails have perished, albeit the efforts to feed them; and our village taxidermist has set up a number of "new birds," brought him by farmers who found them dead, and who say that many small birds have died of starvation. Well, what about Junco? O, he's become jocose; at least he seems to twitter: "This is none of my funeral." But then our Junco can be jolly under trying circumstances, and we must not

write him down as going to the bad, simply because he trends a little on the heartless ways of men.

As hinted above, I think the snow-bird has capacities for human attachments. I saw one at a friend's house which had domiciled for the winter among the plants that filled the bay window. Over these hung a canary cage, the seed spilling from which fell into the flower pots, and were ample for Junco's wants. The bird seemed entirely at home, often leaving the window garden for the wider range of the sitting room. With the first snow of the winter, the bird had entered at an open door of its own accord; and when the spring came it took its departure in the same way.

I find myself so much interested by an account of a caged snow-bird, in a letter from my friend, Dr. Richard E. Kunzé, of New York, that I cannot refrain from giving an extract: "In my aviary I have kept from eighteen to twenty denizens, during the past winter. I had no canary, and only one snow-bird, *Junco hyemalis*, which I obtained from a bird dealer early in the winter. I kept him two months, and I think I had him just two months too long! They are regularly trapped and offered for sale in this city, on account of their frolicsome ways, and not because they are songsters. In song they are much inferior to our purple finch, song sparrow or yellow-bird, yet their song is more varied than that of the lesser red-poll. They also sing at night, and quite frequently when domesticated. His note at night is more of a monotonous character, amounting to just a whirring r-r-r-r-r-r —r-r-r-r-r-r—r-r-r-r, and so on, reminding one of a tree-toad more than anything else. Not being very timid, he naturally becomes very tame. He is rather too much of a pugnacious character for a well kept aviary, and to my sorrow I must confess that when last week I took him to one of the Central Park menagerie aviaries, it was with no great reluctance that I parted with him. Before his banishment he had destroyed the plumage of many a fine bird for me. In putting a new bird in my aviary, it is the aviarian custom to give him a hazing, like any other freshman of a higher order of beings; yet that snow-bird was not molested by any one, which, no doubt, made him bolder. I have in my aviary an African weaver-bird and a Japanese robin, both of which are not to be trifled with, and generally are very aggressive themselves; yet he chased them in pairs, as he did also the indigo bunting, yellow-bird, nonpareil and the smaller birds of the finch tribe.

"He ate every kind of food that he saw the others eat. When satiated he would get into a seed cup and throw out the larger seed, such as unhulled rice. He would then flirt with his feet like a chicken, and in a few minutes empty a cup of seed. After a while I placed a small flat wooden plant label across the cup, held in place by the wire of the cage to prevent him throwing out seed. He would hop along the top of it with the greatest delight, producing well measured sounds, by one end of the label being raised and then suddenly brought down with a sharp clap. While thus performing for minutes at a time, he often uttered low notes, and seemed to keep perfect time with his feet."

So it turned out that the little snow-bird was the coquinet, the clever little rascal of the establishment. I think his ability was exceptional. Perhaps he was a genius in his way; and being too roguishly cute for the general comfort, he must needs go into exile for the good of the community.

Dr. Kunzé informs me that quite a trade is carried on in New York exporting the snow-bird, *Junco hyemalis*, to Europe, and what seems strange is the fact, that the snow-bunting, *Plectrophanes nivalis*, is imported by us from Europe. But I must again quote my friend's letters; he says that "Reiche Brothers, of New York, sometimes take a lot of snow-birds to Europe, more for experiment than to fill orders. A smaller dealer is Mr. Schlawe, who is also trapper and fowler, and who watches the habits of our birds that are in demand very closely. He says that of all birds the snow-bird is certainly difficult to catch, notwithstanding the presence of great numbers in the field. No kind of food, or call-note will enchant this bird, or bring him with any kind of calculation under the fowler's devices. He claims that most of the snow-birds caught are accidental catches, and that it happens when fowlers set limed rods for *other birds!* Out of a hundred birds thus caught, only a very few are snow-birds, and oftener none at all. They will not enter a trap cage. He says that the bird is in fair demand, and that he could sell more than he caught. He says he has kept him through the summer very well, and that he is certainly a most hardy cage-bird. He often takes many to Europe on a single trip, and never lost a single specimen *in transitu*. He often takes these transatlantic journeys. On one of them he had forty snow-birds in one cage, and landed all safely in Germany, finding a market for them in Berlin without any difficulty."

However interesting to the philosopher a new species may be, it is "caviare to the general." If you would please the million show up your "white black-bird." Last summer it was given out that a white robin was in town, and forthwith every avicide from sixteen to forty-five years old, with gun in hand, inspected every shade tree in the village. The bird-killers were foiled. The robin had been and gone. And it was similar with the few who got the word of another arrival one bitter day in this cold February. Just before the gas was lighted "a snow-white snow-bird" had flown into the ticket office of our village depot. It was an albino. The poor bewildered thing sailed round the room close to the ceiling, much as a swallow would do; and what with the glare of the lights, and the heat, and the senseless efforts made to capture it by throwing hats, it had a really hard time. The door being opened, it darted out, and happily escaped; more fortunate than the one seen by Mr. Alcott in Connecticut in 1870.

Has there not been within the memory of man, a marked change in the migration habits of *Junco hyemalis?* They have their stragglers and "tender-foots," who do not go so far north to breed as do the others. Still the laggers seem capable of a topical compromise, nesting higher in the Southern mountains, while their tardier kindred, who venture farther north, nest lower down on the mountain sides. Was there not a time when this nesting southward of our eastern snow-bird was, at most, very exceptional? I see these birds so happy and in such good heart in the severest winter day, that I infer an Arctic constitution in the well-to-do's of the tribe. Were they not once like the snow-bunting, *Plectrophanes nivalis*, which nests as high as Labrador, but which, it seems, has twice been found nesting in the Northern United States. May one who is not even the son of a prophet venture a prediction for the bird men of the future, that the snow-bunting will be found working southward after the example of its cousin the snow-bird.

I do not remember the name of the bard, and fear lest I should garble his classic lines, yet the very best I can do is to quote his verse in an *ad sensum* way;

> "Noah of old, three children had,
> Or sons, I should say, rather;
> Shem, Ham and Japhet, called by dad—
> Now, who was Japhet's father?

The above it appeared was too much for Hodge; he could scratch his ear, but could not answer. Perhaps science has its

Hodges too. At any rate, who will riddle us this concerning the pedigree of our *Junco hyemalis?*

Junco a first ancestor had,
Or great original, rather;
If you'll point out, you'll make us glad,
Our Junco's great-grand-father.

Authors give several species of Junco, as follows, the first three being by some considered as mere varieties: *J. hyemalis*, our eastern snow-bird, *J. aikeni*, the white-winged, and *J. oregonus*, the Oregon snow-bird; besides these are *J. caniceps*, the chestnut-backed, and *J. annectens*, the chestnut-sided snow-bird. This much we must credit to Mr. J. Martin Trippe, as cited though hardly accepted by Dr. Coues. Are these all good species? I cannot go into the controversy, but will ask permission to adduce the following:

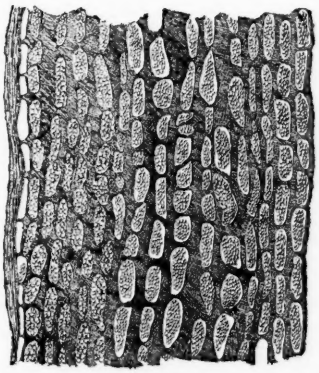
Once upon a time a patronymic dispute arose. With a geographical range so extraordinary as to preclude the idea of dispersion from a common center, there were the Smiths, and the Smithes, and the Smyths, and the Smythes, and the Schmits, and the Smids, and the Smeds. That there were differences also besides the names, was noticeable, such as black eyes, and blue eyes, and gray eyes, and hazel eyes. Still it was observable that what of difference there was, was best appreciated by themselves. But had these slight differences been overlooked, and the real similarities not been neglected; and in other ways, had the modern scientific methods been then in vogue, it might have appeared that in all this diversity there was not anything that had passed the varietal stage; that a nascent species had not been attained; in fact, with respect to the names, it had been suspected that really they were but one and the same cognominal. But an event happened which set all to take the matter in hand seriously; it came out that long ago a great ancestor had died and left "untold wealth" which was waiting the proper claimants. Discussion now brought out the fact that these patronymics were but evolutional variations of the same family name, which had been brought about by modifications of descent, the simple effect of time and circumstance, or in more modern phrase, the environment; for all had descended from one great ancestral stirp—the old, original, genuine *Johannes Smithius*, vulg. John Smith.

Perhaps we may yet decide as satisfactorily the stirp of the Juncos; meanwhile we lean to the belief that a *Junco hyemalis* was the grand ancestor of the whole tribe.

BACTERIA AS A CAUSE OF DISEASE IN PLANTS.

BY PROFESSOR T. J. BURRILL.

CERTAIN diseases of animals are now positively known to be due to the action of the minute organisms commonly known as *bacteria*. They are spoken of as "disease germs" or "spores," and the "germ theory" of disease is very fully discussed in medical literature. Among the best proved examples that the so-called germs are the actual *cause* of disease, we may cite anthrax in cattle, malignant pustule in man, and the diseases of swine and fowl ordinarily known as cholera. Many other contagious diseases of man and the domestic animals are scarcely less clearly known to be due to bacteria, but it has not been shown that they also cause disease and death of plants, except as recently announced by the writer in case of "blight" in pear and apple trees (August, 1880, American Association for the Advance-



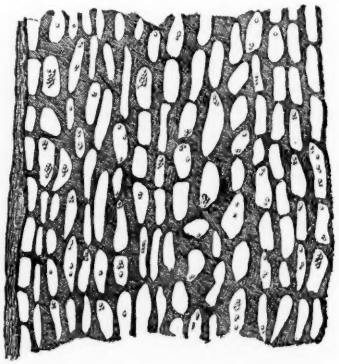
Healthy Pear Bark, showing cells filled with starch. Magnified 125 times.

ment of Science). I am now able to add the "yellows" of the peach with much confidence, without, however, the full investigation given to the former disease.

In 1877 I observed in the fluids of blighting pear trees, great numbers of minute, moving things which were not clearly identified as bacteria until the following year. Their presence was uniformly detected in every examination made (and they were numerous) during the summer of 1878, and the fact was reported to the Illinois State Horticultural Society, in December of that year (Transactions, p. 79). Investigations were not further pros-

ecuted until June, 1880, when the unusual prevalence of the disease called more special attention to it. The same organisms, or those very similar, were as uniformly found in the tissues of apple trees suffering with the disease called twig blight. On diseased parts of both trees, drops of whitish, viscid material were often found, oozing from the bark, and this proved to be almost wholly made up of the bacteria. After some hours' exposure the mass became yellowish, and finally dark-brown. These bacteria are generally double jointed, each article being about .001 mm. (.0000393 in.) in transverse diameter, and about .0015 mm. long. Sometimes, however, the oval single forms are common, and not unfrequently longer ones of several joints are found.

Upon examining the infected tissues, the absence of the starch



Diseased Pear Bark, from limb three weeks afer blight commenced. Magnified 125 times.

granules, so abundant in the healthy cells, was especially marked. Tests revealed the fermentation of this starch with the evolution of carbon dioxide, hydrogen and butyric acid. The other carbonaceous materials in the cells, as sugar, malic acid, &c., doubtless undergoes the same fermentation, but being soluble in water their loss is not rendered evident by the microscope. The cell walls contrary to my expectation, were not found injured, neither was the protoplasm involved in the fermentation.

By passing a thin section of the bark under the microscope, it is possible to find in the same slice, all variations, from perfectly healthy cells to those which have lost the whole of the stored starch, the bacteria likewise varying in numbers as the destruc-

tion of the starch bacteria progresses. How these originally gain entrance to the cells was not made out. There are certainly no pores or other visible openings through which they pass. Water, however, is absorbed by the cell walls, and passes through their molecular spaces in all directions. It may be that in the germ condition the bacteria are really small enough to pass with the water through the walls, notwithstanding the fact the highest powers of our microscopes fail to detect the molecular openings. However this may be, it is positive enough that the adult bacteria do not in this way traverse the cell walls. The evidence is totally against any distribution of the organisms in the tissues by the circulations of water or sap. They slowly make their own way from cell to cell, progressing equally in all directions from the starting point when the same conditions are presented.

On July 1, 1880, I inoculated two pear trees by inserting small pieces of bark from a pear tree in which the disease was in active progress. On the 12th and thereafter, inoculations were made by dipping a clean needle or the sharp point of the blade of a penknife into the viscid substance exuding from diseased bark, diluted or not with distilled water, and thrusting the instrument into the experimental trees. Usually three such punctures were made near each other, but the three were counted as one inoculation.

No visible results followed any of these inoculations during the first eight days, and in some cases for two or even three times this period. In the majority of cases ten to twelve days elapsed before external signs of the disease could be observed. No difference was detected in this or any other respect in the different ways of inoculation. But numerous external applications of the virus were made to the bark and leaves without wounding, none of which seemed to communicate the disease. The trees were examined at least once each day until the 14th of August, 1880, and every observed change carefully noted. Very often the disease could be detected by dissections and microscopical examinations when no external indications were presented, but these were not counted as successful inoculations except in very clear cases.

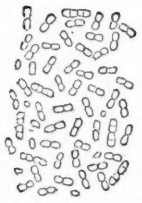
The experiments upon pear trees were made upon trees three years old, Bartlett and Clapp's Favorite, seventy-two in number. The apple trees are Grime's Golden, and the quince, Angers.

The following table gives the results in per cents of the number of successful inoculations:

Number of Experiments.	Kinds of Trees.	Virus from Pear.	Virus from Apple.
36	Pear	54	72
29	Apple	30	Not tried.
4	Quince	100	Not tried.

It will be observed that the virus from the diseased apple limbs was more fatal to the pear than that from blighting pear, showing at least that the disease in the apple is of the same nature as that known as fire blight in the pear. It is quite possible, however, that the greater percentage is due to other causes than the virulence of the inoculating material, and that another set of experiments would show this. The low per centage in case of the apple (30) inoculated with pear virus is partially explained from the fact that ten inoculations were in the bark of portions more than one year old, none of which were successful. As these trees show blight for the most part in the shoots of the current year's growth only, some reason for the failure may be conceived. But four inoculations were made in the quince, all of which communicated the disease. These were made upon the young shoots of a bushy tree which was not otherwise unhealthy.

Since these experiments were made, careful study has convinced me that the death of patches of bark on the trunk and larger limbs of the apple tree is due to the same cause. The disease slowly progresses from the center of infection and kills the tree when the whole circumference becomes involved. Sometimes, however, the liber (the bast cells are not penetrated by the bacteria) forms a complete shield to the inner tissues, and after the outer cellular bark is destroyed a new layer is formed beneath, the old finally falling away.



Blight Bacteria. Magnified 1000 times.

Meteorological conditions probably have some influence, but how much and what is not clear. The disease slowly progresses in winter as well as summer, in dry weather as well as wet. The

sudden appearance often noted is but the blackening of the leaves upon a branch long diseased.

The slow progress of the malady gives the best hope for successful treatment. It has been considered sudden and irregular, with little or no indications of trouble until destruction came; but this is greatly over-stated. Acquaintance with the first appearance in the bark, and careful examination every two or three weeks, will make treatment much more possible than heretofore supposed. The remedy proposed is the old one of cutting away the diseased portions, adding, however, the precaution of taking all infected parts, and not merely such as have become blackish after the ravages are complete, and to observe requisite care in cleansing the knife or other instrument, that by the very process of cure the contamination is not spread. Probably carbolic acid or other antiseptic washes may be useful, but proof from actual and indisputable experiment has not yet been reached.

Very recent examinations of material sent from Michigan conclusively confirms my opinion that the yellows of the peach tree is caused by a similar organism. In the cells of an infected shoot I find very little stored starch, but numerous bacteria. These are seemingly different, under a one-tenth Tolles' or Spencer's objective, from the bacteria of the pear and apple. Compared with the latter, they are long and slender, measuring about .001 mm. by .0035 mm. They consist of several joints, but little longer than wide in what appears to be the typical forms.

The Lombardy poplar trees are also destroyed by these ferment producing agents, following the attacks of certain wood-boring coleopterous larvæ. The latter penetrate the bark and take devious courses through the bark parenchyma and the cambium layer. Starting from their channels, the bacteria slowly spread from cell to cell, until so much of the essential tissue is destroyed that the tree, after some years of hopeless struggle, succumbs. Sometimes the bacteria collect in immense numbers in pockets, which they appear to form in the bark of this tree by absorption of the cell walls. The thick, white mass which they thus form, has the appearance to the unaided eye of pus from sores in the flesh of animals.

The aspen *(Populus tremuloides)* is similarly affected. The young limbs die and the leaves become black in a manner every way similar to those of the pear and the apple.

RECORD OF AMERICAN CARCINOLOGY FOR 1880.

BY J. S. KINGSLEY.

IN continuing the record of American crustacean literature, begun by the writer last year (NATURALIST, XIV, pp. 498–503), the principal papers will be considered under the heads, systematic, anatomical and embryological, and in these by authors in alphabetical order. A complete list of papers, so far as known to the recorder, completes the record.

Descriptive papers have this year been few and are of apparently a better character than is frequently the case, a goodly proportion being monographic in character. Messrs. Harger, Kingsley, Packard and Smith are the only writers who have described new species during the year. Mr. Harger (4) presents a valuable synopsis of all the marine Isopoda of the New England coast, with full synonyma and good illustrative figures. He begins with a general account of the external anatomy of the Isopoda; next comes the systematic portion, by which we find that New England possesses 46 species arranged under 34 genera and 14 families. One new genus and species is described, *Syscenus infelix*, and of this but a single specimen is known. Possibly its solitary condition and consequent lonesomeness prompted the specific name. Following the systematic portion we find a résumé of the geographical and bathymetrical distribution, from which we learn that 11 species are found only south of Cape Cod, 19 exist only north of that barrier, while 16 are common to both sides of the cape, and 11 species are common to both Europe and America. A very complete bibliography concludes the article, enumerating over two hundred titles. We notice, however, that the excellent articles of Schiodte and Meinert[1] are nowhere mentioned. With our marine Isopods in this excellent condition, we wish that Mr. Harger or some other equally competent naturalist would undertake to straighten out the terrestrial forms, on which, with the exception of work by Say, Fitch, Dana and Stuxberg, but little has been done.

Mr. Kingsley has been the largest contributor to systematic carcinology, but this is hardly the place for a critical review of his work. His first paper (7), though issued in the Proceedings of the Philadelphia Academy for 1879, was not printed until the

[1] See NATURALIST, XIV, p. 519, 1880.

beginning of 1880, and hence falls within the scope of this record. It gives an account of the Crustacea collected by Professor H. E. Webster of Union College, in Virginia, North Carolina and Florida, together with a revision of the genera of shrimps. This paper has been noticed by Professor Smith (29). It may be well to say that the genus *Xiphocaris*, which in the article is merged with *Caulurus*, really is distinct, and belongs to the Atyidæ, near *Caradina*, as an examination of the mandibles has shown.

The four remaining papers to be noticed treat of the grapsoid Crustacea. The first (14) is on the Thelphusidæ, describing some new forms and giving notes on the habitats of others. The next (15) is a revision of the fiddler crabs of the world, in which the known species are reduced to forty-one. A further examination of types ard more complete series would probably reduce the number still further. Two new species are described. The Ocypodæ are next treated in the same manner (16), 11 species (1 new) being recognized. The last of the series (17) takes up the family Grapsidæ, giving descriptions and analytical keys to the majority of the forms. The nominal species of *Sesarma* are merely enumerated in alphabetical order, the task of simplifying and straightening them out being too much for the writer. Several genera and many species are thrown into synonymy, and the geographical distribution of many is greatly extended. Two new genera and species are characterized, and, including the Sesarmæ, 159 species are enumerated.

Professor Packard, who has in progress a monograph of the North American Phyllopoda, describes (19) *Streptocephalus floridanus* as new, and gives notes on other Phyllopods.

Professor Smith, our oldest publishing American carcinologist, contributes several short articles which, like all of his papers, add greatly to our knowledge of the Crustacea. In the first of these articles to be noticed (26), the presence of the destructive *Chelura terebrans*, a wood-eating Crustacean, is recorded on our shores. In the next (31) some forms of British Columbia are discussed. A single new genus and species of Cumacea, *Diastylopsis dawsoni* is described, and the notes on the other forms enumerated throw much light on our knowledge of the west coast species. In his paper on *Pinnixa* (32), to be referred to again, the New England species, two in number, are described. The next paper

(33) discusses the presence of certain tropical and subtropical forms on the New England coast. These are ten in number.

Concerning some of the Crustacea described by Thomas Say, there has been considerable uncertainty, and in the case of three genera of Amphipods, Mr. Smith (34) presents us extended descriptions of Say's forms, and settles the disputed points. The genus *Erichthonius* is considered as belonging to a distinct subfamily from *Cerapus*, with which it has been confounded.

Dr. Packard is the only one who has published anything concerning the anatomy of the Crustacea, and his articles have all been upon the eye and brain of Limulus, and are all published in the pages of the NATURALIST, and hence do not need more extended notice here. A more extended paper on Limulus,[1] though bearing date 1880, did not appear until the beginning of the present year, and will be noticed more at length elsewhere.

Dr. Brooks has published preliminary accounts of the embryology of the curious genus *Lucifer* (1 and 2). We understand that the complete history will appear in the Philosophical Transactions of the Royal Society. The most important feature discovered is that the young *Lucifer* is a Nauplius and not a Zoëa as is the case with most Decapods. This discovery adds additional probability to the statement of Fritz Müller that the young of *Peneus* is also a Nauplius.

Mr. Emerton (4) figures the nauplius of a barnacle.

Dr. Faxon (5) discusses the membrane which envelops the larva of *Carcinus mœnas* and the morphology of the zoëal antennæ; seven figures are given of the zoëa of *Panopeus sayi*, and one of the tail of zoëa of *Gelasimus pugnax*. The text is so condensed as not to admit of putting into an abstract, and students are referred to the article itself. The two folded plates accompanying the paper are very good.

Professor Smith's paper on *Pinnixa* (32) should be read in connection with that of Dr. Faxon, noticed in the review of last year.

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ABORIGINAL STONE-DRILLING.

BY CHARLES RAU.

ABOUT twelve years ago, I published an account of my experiments in drilling in stone without the aid of metallic tools,[1] and, though during the interval my attention was constantly fixed upon archæological matters, I had, on the whole, no occasion for changing the opinions then expressed.

In the meantime, however, similar experiments, made by European archæologists, were commented on by Mr. John Evans, who, after a due consideration of the subject of stone-drilling, gives the following summary of methods:

"On the whole, we may conclude that the holes were bored in various manners, of which the principal were—

1. By chiseling, or picking with a sharp stone.
2. By grinding with a solid grinder, probably of wood.

[1] Drilling in Stone without Metal; Smithsonian Report for 1868, p. 392–400.

3. By grinding with a tubular grinder, probably of ox-horn.
4. By drilling with a stone drill.
5. By drilling with a metallic drill.

"Holes produced by any of these means could, of course, receive their final polish by grinding."[1]

It appears doubtful to me whether in North America (north of Mexico) metallic tools for drilling stone were used, considering that the only metal which could have been employed for such purposes was hammered native copper—a substance too soft to be applied to any kind of hard stone without the aid of a very efficient triturated grinding material. Nor do I believe that the former inhabitants had sufficient skill in working copper to fashion it into a tubular tool suitable for stone-drilling; and to my knowledge no such object has ever been discovered in the United States. Soft stone, moreover, could be bored with greater facility by means of properly-shaped flint implements, as will be exemplified in this article. Even bronze, I think, would be found less serviceable than flint for drilling stone of inferior hardness.[2]

Dr. Ferdinand Keller, of Zürich, the meritorious investigator of Swiss lake-habitations, has made quite interesting experiments in drilling stone and other substances employed by the lake-dwellers. He operated on stone with tubular bones of goats and sheep, and with hollow cylinders of stag-horn and yew-wood, these drills being inserted into spindles slightly pressed at the upper end, and set in motion by means of a bow. This apparatus corresponded in general principle to that figured by me on page 399 of the Smithsonian Report for 1868. Water and quartz sand, of course, were necessary agents in the operation. Dr. Keller expresses himself quite satisfied with his success; for there appeared the round, smooth hole, with the characteristic parallel striæ and the core at its bottom, which is always seen in unfinished antique specimens drilled with a hollow tool. The work, however, progressed very slowly, and the operator adds to this statement the observation that no prepared hollow bone, which might have served as a drill, has thus far been discovered in the lacustrine deposits of Switzerland. After these experiments it occurred to him to employ a hollow cylinder made of ox-horn,

[1] Evans: The Ancient Stone Implements, Weapons and Ornaments of Great Britain; London, 1872, p. 48.

[2] For carving on hard stone, such as granite, bronze tools have been found to be almost useless. A trial of this kind is described in my Smithsonian publication entitled "The Palenque Tablet in the United States National Museum," p. 37, note.

and he obtained now more favorable results, owing to the yielding substance of the horn, in which the sand became imbedded and acted like a file. "The objection," he says, "that no drills made of this material have been discovered, is rendered invalid by the nature of the horns of bovines, which are totally dissolved in water in a comparatively short time."[1]

Methods like those employed by Dr. Keller, may have been practiced by the aborigines of this country; yet among the hundreds of bone and horn implements which have passed through my hands during my connection with the United States National Museum, not one exhibited the character of a hollow drill, and I am not aware that any of the collections of this country contains such a tool. But I must not omit to state what I learned in 1875 from a Warm Spring Indian belonging to a delegation which had come to Washington for the purpose of transacting business with the Government. These Indians were well supplied with pipes, mostly made of alabaster, and shaped like the ordinary catlinite pipes. With some difficulty I obtained from one of them the information that they drill the cavities of their pipes with bone tools, and, in order to strengthen his assertion, he led me to a case in the Museum in which objects of bone were exhibited. The cavities of their pipes, some of which were purchased from them, appear to have been produced by solid rather than hollow drills. According to Catlin, the pipes made of the material now named after him, are (or were) drilled by means of a wooden stick, in conjunction with sand and water.

In my account of drilling, referred to in the beginning of this article, I should have stated with greater emphasis that, in illustrating the possibility of perforating very hard stone by employing a revolving stick and sand and water, I was far from underrating the efficiency of a flint tool for drilling stone of less obdurate character. In operating with a well-pointed flint arrow-head, firmly set in the cleft end of a short stick, on a fragment of a pierced tablet of tolerably hard slate, I produced in about half an hour a small perforation in no way distinguishable from one made by an aboriginal worker in stone. The perforations in these tablets are either conical or bi-conical. By drilling from both sides of the fragment I made one of bi-conical form; if I had continued

[1] Keller: Durchbohrung der Steinbeile, Hirschhornwerkzeuge und anderer Geräthe aus den Pfahlbauten, in: Anzeiger für Schweizerische Alterthumskunde; Zürich, Juni, 1870, S. 139–144.

to drill from one side only, the bore would have assumed a conical shape. I simply turned the improvised tool with the hand like a gimlet, exerting a moderate pressure, and wetting the cavity from time to time with water. During the operation very diminutive particles of the drilling tool came off with a slight crack, and the flint showed afterward scarcely any wear. This fact is worth noting, as it accounts for the fresh appearance of many flint tools which undoubtedly have served for drilling purposes.

Any one who has handled a large number of North American flint implements must be aware that there are some which approach in outline more or less the arrow-head shape, but exhibit a rounded edge instead of a point. They might often be taken for cutters; yet many of them, I am now inclined to believe, served as tools for boring stone of inferior hardness, the curved extremity forming, of course, the penetrating part of the drill. My view is based upon the fact that an implement of this kind actually has been found in the unfinished bore of an aboriginal stone object, now in possession of Mr. James Wood, of Mount Kisco, Westchester County, New York. Last year that gentleman, who is President of the Westchester County Historical Society, was kind enough to send the partly-drilled specimen, together with the drill, for examination to the Smithsonian Institution, where I caused drawings of both to be made. The objects were found at Croton Point, on the Hudson, in Westchester County, by Mr. Wood's cousin, a lad about thirteen years of age, whose veracity cannot be doubted, and who is not at all given to collecting aboriginal relics, of which, indeed, he has no knowledge. The genuineness of the discovery is beyond any suspicion.

Figure 1 shows the character of the drilled object, which is a rather rude exemplification of a type not unfrequent in the United States, and represented by a number of specimens in the archæological collection of the National Museum, where I have classed them for the present with the drilled ceremonial weapons, sometimes very inappropriately called "banner-stones."[1]

The specimen in question consists of chloritic potstone, a very soft material, which could easily be fashioned and drilled. The

[1] A specimen not unlike the original of Figure 1, though larger and of a more regular shape, was found in the town of Monkton, Vermont. It is figured and described in "Proceedings of the American Association for the Advancement of Science" (Twenty-eighth meeting, August, 1879); Salem, 1880, p. 526, etc.

bore is an inch and a half deep and nine-sixteenths of an inch in diameter at the orifice. It is straight and smooth, but shows parallel furrows or striæ impressed by the corners and slight lateral projections of the drill. The latter, represented by Figure 2, consists of black hornstone and is very carefully chipped. It is an entirely uninjured specimen. When Mr. Wood's young relation found the potstone implement, its bore was filled with earth, the removal of which brought to light the flint drill. It stuck in the

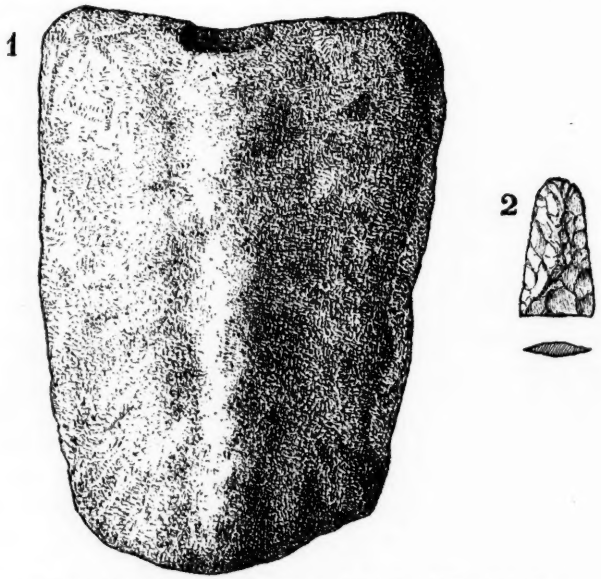
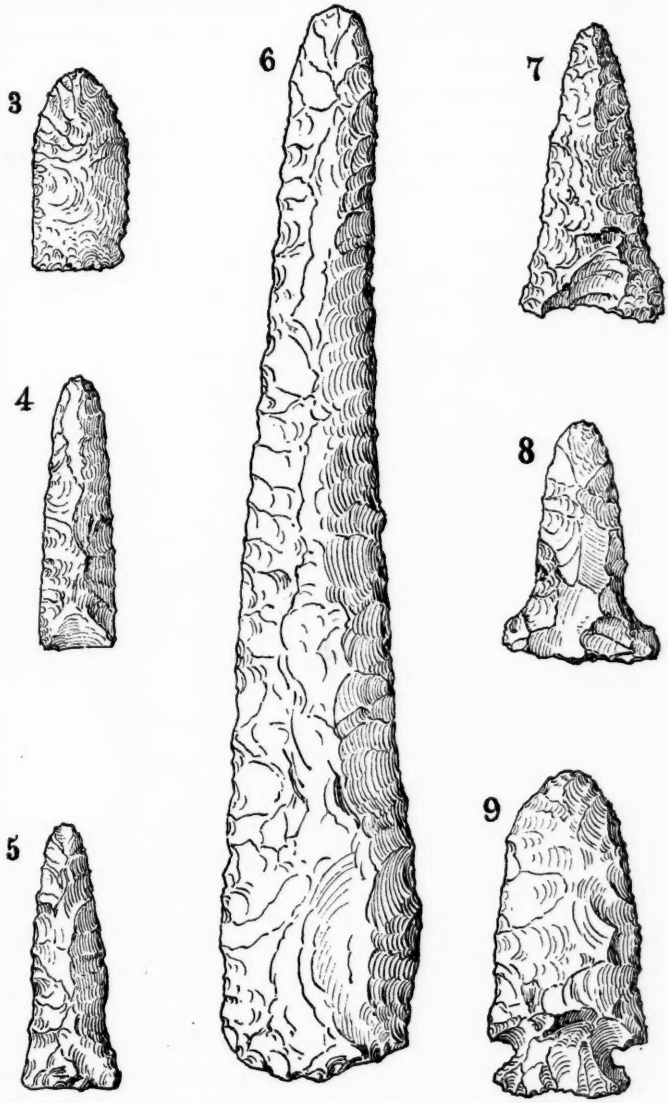


FIG. 1.—Stone object with unfinished bore, and (2) the drill used in the operation. Westchester County, New York (natural size).

lowest part of the bore, which exhibits here a shape corresponding exactly to the somewhat tapering form of the tool. No trace of a handle, without which the drilling could not have been performed, was found. Its material—doubtless wood—had totally disappeared.

It rarely happens that a discovery of such demonstrative character is made, and I therefore concluded to publish the present account, which, no doubt, will be of interest to the many who care for the details of North American archæology.

In Figures 3–9 I present delineations of some of the stone implements in the National Museum, which resemble more or less



FIGS. 3–9.—Stone drills in the U. S. National Museum (natural size).

Mr. Wood's specimen, and to which I ascribe the character of drills.[1]

Figure 3.—Original made of light-brown stone of chalcedonic appearance. Colorado. (Museum No. 9208.)

Figure 4.—Yellowish flint. Ohio. (Museum No. 16,484.)

Figure 5.—Gray jasper. New York. (Mus. No. 6180.)

Figure 6.—Cast of a large implement of brownish hornstone. The original is in possession of Mr. L. Leppelman, of Fremont, Ohio. (Museum No. 35,624.)

Figure 7.— Yellowish-brown jasper. Connecticut. (Museum No. 6084.)

Figure 8. — Dark-gray hornstone. Ohio. (Museum No. 16,484.)

Figure 9.—Light-reddish jasper. West Virginia. (Museum No. 13,376.)

Having properly hafted the original of Figure 8, I operated with it on a piece of an aboriginal potstone vessel, three-fourths of an inch in thickness, which I perforated in about twelve minutes, the result being a bore not quite as regular as that exhibited in Mr. Wood's specimen, but otherwise resembling it in all essential points. The manipulation was the same as in the previously-described experiment by which I obtained a small bi-conical perforation.

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ON THE EFFECT OF IMPACTS AND STRAINS ON THE FEET OF MAMMALIA.[2]

BY E. D. COPE.

THE principal specializations in the structure of the feet of the Mammalia may be summarized as follows:

I. The reduction of the number of the toes to one in the *Perissodactyla* (horses, etc.), and two in the *Artiodactyla* (cloven feet).

II. The second hinge-joint in the tarsus of the *Artiodactyla.*

[1] The specimen from the Yorkshire Wolds, represented by Figure 231 on page 291 of Mr. Evans's work (Ancient Stone Implements, etc.) appears to belong to the same class of tools.

[2] Read before the National Academy of Sciences, April, 1881. Abstract. Some of the points of this paper have already been discussed in the NATURALIST (April), but the present abstract contains additional matter.

III. The trochlear ridges and keels at the various movable articulations of the limbs. These are as follows:

1. Looking downwards—
   - *α*. Intertrochlear crests of the humerus.
   - *β*. On the carpal end of the radius.
   - *γ*. Metacarpals, distal ends.
   - *δ*. Tibia distally.
   - *ε*. Metatarsals distally.
2. Looking upwards—
   - *α*. Radius distally.
   - *β*. Astragalus, edges.
   - *γ*. Astragalus distally (*Artiodactyla*).
   - *δ*. Phalanges (very weak).

The following observations may be made respecting the structures included under division III: The trochlear keels which look downwards are much the most prominent and important. Those enumerated as looking upwards are weak and insignificant, or of a different character from the down-looking ones. The latter are all projections from the middles of the ends of the respective elements. The up-looking are generally projections of the edges of bones. Such are the lateral crests of the astragalus,

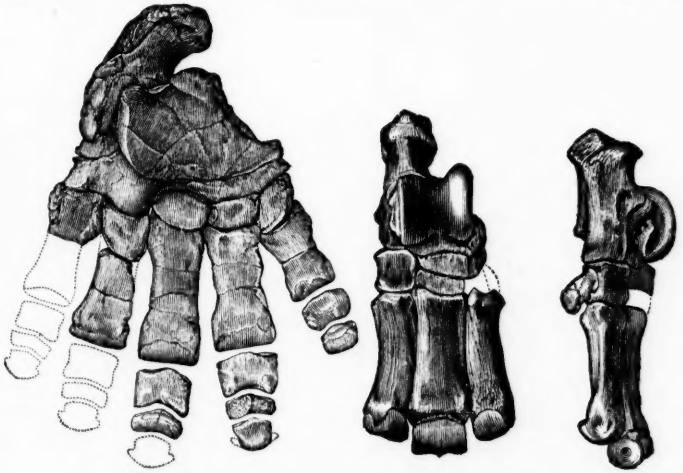

FIG. 1. FIG. 2.

FIG. 1.—Right posterior foot of a species of *Coryphodon* from New Mexico, one-half nat. size. From Report Expl. W. of 100th Mer., G. M. Wheeler, IV, Pl. LIX.
FIG. 2.—Right posterior foot of *Aphelops megalodus* Cope, from Colorado, one-half natural size. From Report U. S. Geol. Surv. Terrs., F. V. Hayden, IV, Pl. CXXX.

and the adjacent edges of the cuboid and navicular bones which

cause the distal emargination of the astragalus in the *Artiodactyla.* The proximal ridges of the phalanges are very weak, and the concavities in the extremity of the radius cannot be called trochlear, as they are adaptations to the carpal bones.

I. The reduction in the number of toes is supposed to be due to the elongation of those which slightly exceeded the others in length, in consequence of the greater number of strains and impacts received by them in rapid progression, and the complementary loss of material available for the growth of the smaller ones. This is rendered probable from the fact that the types with reduced digits are dwellers on dry land in both orders, and those that have more numerous digits are inhabitants of swamps and mud. In geological history it is supposed that the Perissodactyles

FIG. 3.

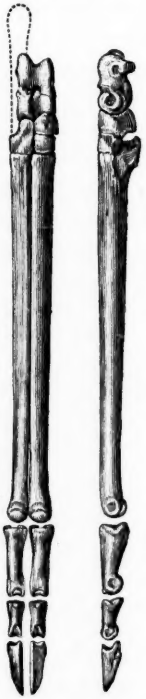

FIG. 4.

FIG. 3.—Right posterior foot of *Protohippus sejunctus* Cope from Colorado, about one-half natural size. From Report U. S. Geol. Surv. Terrs., F. V. Hayden, IV.

FIG. 4.—Right posterior foot of *Poëbrotherium labiatum* Cope, from Colorado, three-fifths nat. size. From Hayden's Report, IV, Pl. CXV.

(figures 2–3) originated from the *Amblypoda*, or primitive *Ungulata* (figure 1), which first assumed terrestrial habits, while the *Artiodactyla* (figures 4 and 9–11), originating from the same order, long continued as mud dwellers; as witness the hippopotami and hogs of to-day. The mechanical effect of walking in the mud is to spread the toes equally on opposite sides of the middle line. This would encourage the equal development of the digits on each side of the middle line, as in the cloven-footed types. In progression on hard ground, the longest toe (the third) will receive the greatest amount of shock from contact with the earth. There is every reason to believe that shocks, if not excessive, encourage growth in the direction of the force applied. This is strongly suggested by the relations between the length of the legs and the rate of speed of animals; and the lengths of the teeth and their long-continued use. Certain it is that the lengths of the bones of the feet of the Ungulate orders have a direct relation to the dryness of the ground they inhabit, and the possibility of speed which their habitat permits them, or necessarily imposes on them.

II. The hinge between the first and second series of tarsal bones in the *Artiodactyla*, may be accounted for by reference to the habits which are supposed to have caused the cloven-footed character. Observation on an animal of this order walking in mud, shows that there is a great strain anteroposteriorly transverse to the long axis of the foot, which would readily cause a gradual loosening of an articulation like that connecting the two series of tarsals in the extinct *Amblypoda*. Any one who has examined this part of *Coryphodon* will see that a little additional mobility at this point would soon resemble the second tarsal joint of the hogs. In the case of animals which progress on hard ground, no such cross-strain would be experienced, and the effect would be to consolidate by flattening the fixed articulation.

III. The trochleæ. These prominences, which form the tongues of the tongue and groove articulations, exhibit various degrees of development in the different *Mammalia*. Those of different parts of the skeleton coincide in their condition in any one type of ambulatory *Mammalia*, and so may be all considered together. This fact suggests strongly that they are all due to a common cause.

They are all imperfect in the *Rodentia* and *Carnivora* (figures 5–6) (except the *Leporidæ*, which are especially characterized by

their great speed). Among ungulates they are very imperfect in the *Proboscidea*. The orders mentioned all have elastic pads on the under sides of their feet or toes. The same is true of the lowest types of both the *Artiodactyla* and *Perissodactyla*, the hippopotami and rhinoceroses. In the *Ruminantia* the trochleæ are well developed (figure 10) with one ex-

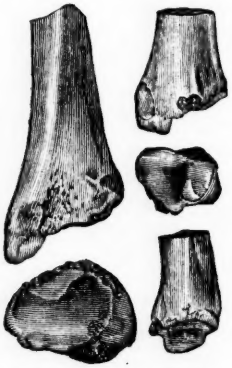

FIG. 5. FIG. 6.

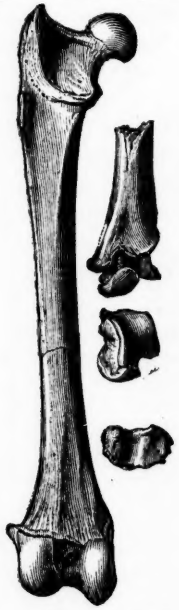

FIG. 8. FIG. 7.

FIG. 5.—Distal extremity of tibia of *Amblyctonus sinosus* Cope. FIG. 6.—Distal extremity of tibia of *Oxyæna morsitans* Cope. Both flesh-eaters and two-thirds natural size. From Report Expl. and Surv. W. of 100th Mer., G. M. Wheeler, IV, Pt. II.

FIG. 7.— End of tibia and astragalus of *Archælurus debilis*. FIG. 8.— Femur of *Nimravus gomphodus*. Carnivora, one-third natural size. Mus. Cope.

ception, and that is the distal metacarpal and metatarsal keels of the *Camelidæ* (figure 9). These animals confirm the probability of the keels being the effect of long-continued shocks, for they are the only Ruminants which have elastic pads on the inferior sides of their digits.

That these processes may be displacements due to shocks long-continued, is rendered probable by the structure of the bones themselves. (1) They project mostly in the direction of gravity. Constant jarring on the lower extremity of a hollow cylinder with soft (medullary) contents, and flexible end walls would tend to a decurvature of both inferior and superior adjacent end walls. If the side walls are wide and resistant, the projection will be median, and will be prolonged in the direction of the

flexure of the joint. (2) They fit entering grooves of the proximal ends of corresponding bones. These will be the result of the same application of force and displacement, as the protrusion of the inferior, commencing with a concavity (*Elephas*); becoming

FIG. 9.

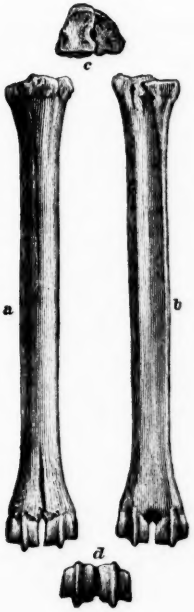

FIG. 10.

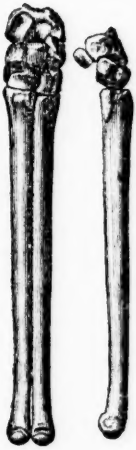

FIG 11.

FIG. 9.—Part of anterior foot of *Procamelus occidentalis* from New Mexico. From Report of Capt. G. M. Wheeler, Vol. IV, Pt. II.

FIG. 10.—Metacarpals of *Cosoryx furcatus* from Nebraska, two thirds natural size; *a*, anterior face; *b*, posterior; *c*, proximal end; *d*, distal end.

FIG. 11.—Left forefoot with part of radius of *Poëbrotherium vilsoni* Leidy, from Colorado, three-fifths natural size. From Hayden's Report, IV.

more concave (Fig. 7), and becoming finally a groove. (3) When the dense edge of a bone, as in the case of the lateral walls of the astragalus, is presented upwards, a groove is produced in the

down-looking bone; *e. g.*, the lateral grooves of the distal end of the tibia. (4) When the inferior bones are the denser, the superior articular face yields; *e. g.*, the distal end of the radius to the first row of carpals (Fig. 11).

(5) The metapodial keels commence in the lower types on the posterior side of the distal extremity of the bone. This is partly due to the presence there of a pair of sesamoid bones, which with the tendons in which they are developed, sustain and press on the lateral parts of the extremities, and leave the middle line without support.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— Morphological biology treats of the relations of solid bodies of organic origin. These solid bodies are often in the highest degree irregular in form, as for instance, the squamosal bone, or the liver, of vertebrated animals. The mental handling of such material requires faculties which belong to the artist and the mechanic, together with a capacity for generalization not essential to either of those classes of specialists. The mastery of any considerable number of organic forms requires the exercise of a thorough analysis of them, which of course presupposes good perceptive faculties. The latter form the important class which furnishes material to the reflective department of the mind, and without which the grandest powers of thought wander aimlessly in the search of truth, for want of fundamental facts.

While a definite idea of the forms of organic bodies is necessary to the biological thinker, the power of describing them is necessary to the biological writer. It is absolutely essential that the describer of structure and form shall use language which is not susceptible of several meanings, and that he shall know how to express contrasts when describing different objects. It is not uncommon to find divisions or groups of various grades defined in somewhat the following manner: Div. I. Legs long; bill curved; Div. II. Tail truncate; legs scaly. On reading this, the inexperienced student is impressed with the occult wisdom of the oracle, while the scientist, on the other hand, feels his fulminate one degree denser than before. Our experience leads us to sug-

gest that the faculty of analytical description sorely needs cultivation. It cannot be called a lost art until it shall have been found. Word painting is a high art, and the highest type of it is that which conveys to the mind of the reader a definite idea of the actual form of the object described. To accomplish this result ponderous nomenclatures have been created, and they are in a large degree necessary; but he displays the greater art who renders complex bodies as it were visible, by the use of the simple materials of ordinary language.

In view of the difficulties experienced by some in satisfying this necessity, much stress is laid, by many persons, on the importance of pictorial illustration. This we believe to be well, not only as a concession to the average of human capacity, but as greatly lightening the mental stress of the true scientist. Nevertheless there are three considerations in relation to this subject which have impressed us, and which we here venture to state:

(1) Pictures can never relieve an author of the necessity for good analytical description, because various points of an object cannot be shown by the number of representations which are within the reach of the average biologist. In the field of science the picture-maker may be a useful man, but he can never be a substitute for the analytical taxonomist.

(2) That pictures can never relieve the author from specifying the characters of his higher groups, as genera, families, etc., is self-evident.

(3) Iconography is only within reach of naturalists in proportion to their financial ability. Poverty should not condemn genius to inaction and obscurity.—*C.*

—— We have received a circular from the committee on instruction of the Academy of Natural Sciences of Philadelphia, asking for subscriptions towards the expenses of the next winter's course of lectures, and for endowments of some or all of the lectureships provided for in the by-laws of the institution. We hope this request will be liberally responded to by citizens, so that we may add to our various educational agencies, a course like that of the Jardin des Plantes of Paris.

We wish here to recall the fact that an academy of sciences can only introduce teaching as a collateral activity, as its primary object is original research. The professorships in question were not created for teachers only, but as positions for original investigators of distinguished merit. Such men will be generally good lecturers also. Should the council of the Academy appoint to these positions any but its first original investigators, it will be in danger of losing its character as an Academy of Sciences and its very *raison d'etre.* Every candidate for a lectureship should, therefore, be required to furnish a list of his papers descriptive of original discoveries he has made.

—— We have received the following from a distinguished correspondent:

ALBANY, MAY 14, 1881.

Gentlemen:—I have received the notice extracted from AM. NATURALIST, in reference to an invitation to the British Association for the Advancement of Science to meet in America in 1883.

I approve of the invitation, which it will be necessary to repeat before its acceptance.

It is well to begin the invitation in order that we may approach the object which sooner or later I believe will be accomplished.

Very truly yours, JAMES HALL.

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RECENT LITERATURE.

SEMPER'S ANIMAL LIFE AS AFFECTED BY THE NATURAL CONDITIONS OF EXISTENCE.[1]—The author's aim in preparing the lectures which he originally delivered before the Lowell Institute, at Boston, and which are here presented to the reading public, is expressed in the following words, to be found in the preface: "It appears to me that of all the properties of the animal organism, variability is that which may first and most easily be traced by exact investigation to its efficient causes; and, as it is beyond a doubt the subject around which at the present moment the strife of opinions is most violent, it is that which will be most likely to repay the trouble of closer research." Professor Semper, therefore, endeavors, and we think with a good degree of success, to present a general view of those facts and hypotheses which bear upon the subject, and which are either of universal significance or, from his own point of view, appear to offer favorable subjects for experimental treatment. The work is not an attempt at a general argument for the evolution hypotheses. If it was, a great many more views and facts might have been presented, but the value of the book is that it is mainly an original contribution to the general subject of evolution from the point of view of experiments on the relations between animals and their environment, which may be largely made in the laboratory, as well as in the field. The subject of endeavoring to account for the *origin* of the variations of species, of seeking for the efficient causes of variability, is not unfamiliar to American naturalists. Darwin professedly starts from the tendency to variation, and his theory, as such, ignores or opposes any thing like Lamarckianism or the influence of the environment on the organism. A few American writers have felt that we must endeavor to seek the causes inducing the tendency to variation, and have thus been led to what we may call a modified, scientific form of Lamarckianism. In order that the organism may undergo change

[1] *The International Scientific Series.* Animal Life as Affected by the Natural Conditions of Existence. By KARL SEMPER, Professor of the University of Würzburg. With two maps and 106 wood cuts. 12mo, pp. 472.

it must first be acted upon by a change in its surroundings, and the change must then be transmitted to its descendants. This is (1) modern Lamarckianism. Then, when the organism or set of organic forms are really in a stage of inequilibrium or of change, the principle or forces of (2) natural selection, or Darwinism, come in, eliminating the useless and preserving the useful forms. Thus Lamarckianism, in its modern shape, forms the base of the pyramid of evolution and Darwinism the apex. Lamarck and his followers (whether conscious of their intellectual descent from the learned and philosophic Frenchman or not) are endeavoring to lay the foundation. Meanwhile, Darwin and his English and German colaborers have began at the top and worked downward. While Professor Semper does not mention Lamarck, his entire line of thought is that of a modern Lamarckian, or what Lamarck would probably have been had he lived in the present half century. The work before us is not metaphysical, as is Darwinism. The term "natural selection" is seldom, if ever, completely personified as an efficient cause or active law, but we are, on the contrary, treated to the results, so manifold, of the effects upon animals of changed conditions of life by changes wrought artificially or in the laboratory of nature. The author, instead of taking up example after example, as do Darwin and especially his followers, and endeavoring to explain their variation by hypothesis piled on hypothesis, like the pile of metaphysical truths of old-school metaphysicians, which may be deftly demolished by removing the premise or undermost brick—the author, we say, works on the inductive method, and endeavors at least to plant his first brick on a substratum of facts tested by experiment. As Semper remarks at the end of his book, "No power which is able to act only as a selective and not as a transforming influence can ever be exclusively put forward as the proper efficient cause—*causa efficiens*—of any phenomenon. In all cases, including those of mimicry, the point finally must be to investigate the causes which may have availed to produce by their direct action any advantageous and protective change of coloring. It was not until the change had actually taken place that selection between better or worse endowed individuals could lead to the further development of the advantageous character. * * It becomes imperative that we should, in the first place, carry out the most exact research possible by means of experiment, and also wean ourselves of the convenient—but, as it seems to me, highly pernicious—habit of theoretical explanations from general propositions. Otherwise, there is great danger that the bright expectations which Darwin has opened out to us by his theory may be baffled—the prospect of gradually bringing even Organic Being within reach of that method of inquiry which seeks to discern mechanical efficient cause."

How the author has carried out his intentions may be seen by a perusal of the chapters which treat of food and its influence, the

influence upon animals of light, of temperature, the influence of stagnant water, of a still atmosphere, of water in motion, or currents, as a means of extending or hindering the distribution of species, and, lastly, on the transforming influence of living organisms on animals, and the selective influence of living organisms on animals. Unless we are mistaken, the method of studying the causes of evolution, *i. e.* by observation and experiment, will be in the end far more sound and fruitful than those of pure, metaphysical Darwinism, as it tends to become in the hands of ultra Darwinians. The methods are more like those of the physical and mathematical astronomer. Zoölogy will, in consequence be more of an exact science and possess more real interest and value in the eyes of the masses than it now does.

The chapters on the influence of light and of temperature are particularly suggestive. So is the fifth chapter, on the influence of stagnant water, which embraces the results of the experiments of Schmankewitsch on the brine shrimp; also those of Semper on the effect of changes in the volume of water on the pond snail. The portion which is quite novel, and which will attract general attention, is Semper's theory of the origin of coral islands. He attempts to show that the connection between the strength and direction of ocean currents, and the vigor of growth in the corals and in the reefs they form, is one of the principal causes that have given the reefs their frequently very remarkable forms. This view is, he claims, in direct contradiction to Darwin's theory of subsidence, as well as Dana's theory. It is more of a piece with Moseley's theory recently proposed, although it is not impossible that Darwin's, as well as Dana's, on the one hand and Moseley's and Semper's on the other, may all be the terms of a series of causes.

The book teems with facts which will be new to most of our readers, and hence it is a solid contribution to the evolution theory. Compared with Oscar Schmidt's crude and one-sided presentation of Darwinism, in his little book entitled Descent and Darwinism, Semper's will remain a classical work, from its basis of well-grounded facts.

Without careful search for errors we notice that under the head of hybridism several cases known in the United States among the deer and Salmonidæ are not referred to (perhaps they were not accessible to the author), while the statement that several species of insects produce hybrid offspring may, if we mistake not, be modified, since about one hundred such cases are on record. The singular Branchipod genus Thamnocephalus cannot be said to occur in the "South of the Union," for its only known habitat is Kansas, on the eastern edge of the Rocky Mountain plateau. We notice a few typographical errors, and the index is too short and quite defective.

ANNIVERSARY MEMOIRS OF THE BOSTON SOCIETY OF NATURAL HISTORY.—Following the example of German scientific societies,

the Boston Society of Natural History has published a thick quarto volume of memoirs, contributed by its members and designed to commemorate the fiftieth anniversary of the society's foundation. The scientific portion is preceded by a minute, detailed history of the society by its late president, Thomas T. Bouvé, Esq., which will possess great interest to the immediate friends of the society, and will also serve as a monographical account of the origin and development of our most vigorous and model natural history society. It appears that the enthusiasm, zeal, and unremitted and unpaid toil of its founders, together with the high scientific character of its president and officers, and more particularly the influence of the late Professor Jeffries Wyman, led men of wealth and refinement to liberally endow it. The following memoirs are contained in this elegant volume, and have in part been noticed in this journal, while others will be hereafter. Mr. Bouvé's history occupies 250 pages, and is illustrated with two plates and nine portraits. The following is the table of contents:

Propositions concerning the classification of lavas considered with reference to the circumstances of their extrusion, by N. S. Shaler (15 pp.); The genesis of the Tertiary species of Planorbis at Steinheim, by Alpheus Hyatt (114 pp., 9 pl.); The Devonian insects of New Brunswick, by S. H. Scudder (41 pp., 1 pl.); The Gymnosporangia, or cedar-apples, of the United States, by W. G. Farlow (38 pp., 2 pl.); A structural feature, hitherto unknown among Echinodermata, found in deep-sea Ophiurans, by Theodore Lyman (12 pp., 2 pl.); The development of the squid, *Loligo pealii* Lesueur, by W. K. Brooks (22 pp., 3 pl.); The anatomy, histology and embryology of *Limulus polyphemus*, by A. S. Packard, Jr., (45 pp. 7 pl.); On the identity of the ascending process of the astragalus in birds with the intermedium, by E. S. Morse (10 pp., 1 pl.); Contributions to the anatomy of the milkweed butterfly, *Danais archipus* Fabr., by Edward Burgess (16 pp., 2 pl.); Studies on the tongue of reptiles and birds, by C. S. Minot (20 pp. 1 pl.); Notes on the crania of New England Indians, by Lucien Carr (10 pp., 2 pl.); The feeling of effort, by William James (32 pp.); On the development of a double-headed vertebrate, by S. F. Clarke (6 pp., 1 pl.).

Brooks' Development of the Squid.—In this paper, which is reprinted from the Anniversary Memoirs of the Boston Society of Natural History, Professor Brooks describes and figures many of the stages in the development of the common squid, *Loligo pealii*, observed by him at the mouth of Chesapeake bay. The development is remarkably direct, there being no approach to a metamorphosis. The method of formation of the shell area and of the shell, the mode of origin of the mantle and of the mantle cavity, and the form and position of the gills of the Cephalopod embryo are more closely like those of the typical Gasteropod than

are to be inferred from the condition of these organs in the adult, and thus enable us to better understand the homology between the Cephalopod and a typical Mollusk than before, as first shown by Grenacher, while Professor Brooks has discovered several additional stages which enable him to correct some of Grenacher's conclusions and to fill up the gaps in the evidence bearing on this subject. The yolk sac Professor Brooks regards as the homologue of the gasteropod foot; the arms of the Cephalopods have no homologues in the Gasteropods, but may, perhaps, be the equivalents of the "cephaloconi" of the Pteropod, Clio; Brooks also believes that the siphon is a structure peculiar to the Cephalopods, with no equivalent in the Gasteropods. The views of Huxley, Grenacher and Von Ihering are presented, with the author's reasons for agreeing with or dissenting from them.

SECOND REPORT OF THE U. S. ENTOMOLOGICAL COMMISSION.[1]—This volume of four hundred pages gives the results of the labors of the Commission during the years 1878 and 1879. It is divided into fourteen chapters, of which the most are of a practical nature relating to the following subjects: Additions to the chronology of locust ravages; the relation of the locust and its ravages to agriculture and the settlement of the Territories; facts concerning and laws governing the migrations of locusts in all countries; habits and characteristics of locusts in all countries within the areas of permanent distribution, so far as these relate to their movements; influence of meteorological conditions on the development and migrations of locusts; the southern limits of the distribution of the Rocky Mountain locust; summary of locust flights from 1877 to 1879: locust ravages in California; and courses that may be adopted by the General Government to lessen locust injury. The more purely technical and scientific chapters are those on the histology of the locust and Anabrus, by Dr. C. S. Minot, illustrated with seven plates; the brain of the locust, by A. S. Packard, Jr., with seven plates; and further facts about the natural enemies of the locust, by C. V. Riley, with a colored plate. A chapter on the western cricket, often so destructive to vegetation in the Western Territories, is inserted, with an illustrated account of the internal and external anatomy of Anabrus; while the appendix contains the description of a number of new species of grasshoppers collected by the Commission in the West, prepared by Mr. S. H. Scudder, and illustrated with a lithographic plate.

[1] *Department of the Interior. Second Report of the U. S. Entomological Commission for the years 1878 and 1879*, relating to the Rocky Mountain Locust and the Western Cricket, and treating of the best means of subduing the locust in its permanent breeding grounds, with a view of preventing its migrations into the more fertile portions of the Trans-Mississippi country, in pursuance of appropriations made by Congress for the purpose, with maps and illustrations. CHARLES V. RILEY, A. S. PACKARD, JR., and CYRUS THOMAS, Commissioners. Washington, 1880. 8vo, pp. 322, appendix 80, with seventeen plates.

The third report of the Commission has been ordered by Congress, while a fourth upon the cotton worm and other cotton insects is in preparation. Five bulletins have appeared and three others are either in press or nearly ready for the printer. These bulletins will eventually form a volume relating entirely to practical or applied entomology.

RECENT BOOKS AND PAMPHLETS.—Ueber eine Sammlung von Fischen, welche Hr. Dr. Gerlach in Hong Kong gesamt hat. Prof. W. Peters, Akademie der Wissenschaften zu Berlin. 8vo, pp. 10, plate. Berlin, Dec. 13, 1880. From the author.

Fuhrer durch die Geologischen Sammlungen in Museum des Königreiches Böhmen in Prag. Dr. Ant. Fric. 8vo, pp. 40. Prag, 1881. From the author.

Catalogue des Mammiferes vivants, et Fossiles, Rodentia (Suite). 8vo, pp, 70. Paris, 1881. From the author.

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GENERAL NOTES.

BOTANY.[1]

THE GROWTH OF STARCH GRAINS.—At the suggestion of the editor of this department, I have prepared the following résumé of the results of my recent investigations. A fuller account appeared in *Bot. Zeit.*, 1881, No. 12 *et seq* (Untersuchungen über das Wachsthum der Stärkekörner).

The investigation of the development of starch grains yields several facts altogether unreconcilable with the well known theory of Nägeli, according to which they grow by intussusception. It was found that the middle part of the grain is formed first and the outer parts successively deposited around it. This is shown by the characteristic corroded structure of the small grains of many young organs, which can still be recognized very easily in the central part of the old grains, and by the comparison of grains of different age.

The corroded structure is due to the well-known circumstance that the starch of young plant-organs is only a transitory deposit which is partially used up again for the formation of cell-walls. The storing up of definitive starch begins only when the organ has reached its definitive size, and takes place partially around the remnants of the transitory grains, and partially by the formation of new grains which are of spherical shape and of course without any corroded appearance. These statements were based on observations made principally upon the starch grains of the cotyledons of *Dolichos Lablab, Vicia Faba* and those of the stem of *Cereus speciosissimus.*

Nägeli's theory, however, seemed to be firmly established by the following properties of starch-grains: (1) Their being made up of regularly alternating more and less watery layers, the outermost being always least watery (densest). (2) The difference of consistence between small grains and the middle part of the large ones, the first being very dense, the latter very watery. (3) Their unequal growth in different directions. (4) The growth of compound and half compound grains being, according to

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

Nägeli, strongest between the nuclei, while growth by apposition would only take place at the periphery of the grains. (5) The partial grains of compound and half compound grains being more watery than simple grains of similar size.

In the discussion and explanation of these properties, the remarkable inner differentiation of starch-grains is first considered. The development of simple granules which was found to agree in the most important points with the observations of Nägeli, excepting the peculiar properties above referred to and belonging to a limited number of plants, may be summed up as follows: (1) Young grains consist of very dense, highly refractive substance. (2) Later a less refractive, more watery spot (nucleus) appears in the center. (3) More aged grains have three or several layers, the outermost being always very dense and highly refractive. (4) The inner substance becomes more watery as the grains increase in size.

According to the generally adopted views of Nägeli, these facts are held to prove that the inner structure is not due to a successive deposit of alternating more and less dense layers around a highly watery primary grain, but that the more watery layers and the nucleus have been differentiated within the less watery substance. The investigation of the physical properties of starch-grains leads, however, to an explanation of these properties which by no means requires the adoption of the theory of growth by intussusception. These properties are the following: (1) Starch grains are rather brittle parallel to the layers, but very extensible perpendicularly to them. (2) Cutting, crushing or extension causes the dense starch-substance to swell up considerably and to take all the properties of the more watery parts of intact grains. (3) Swelling up in water is much stronger parallel to the layers than perpendicularly to them.

Nägeli holds that the tensions, the presence and intensity of which he clearly recognized, are due to the intercalation of new starch molecules being greater in the tangential than in the radial directions; according to him these tensions would cause the formation of a central cavity in the homogeneous young grain, and later the division of the dense layers; and in the so-formed spaces a deposit of watery starch would take place. These views have not been confirmed; firstly, as to the cause of the tensions, which are due not to the unequal intercalation of starch-molecules, but to the unequal swelling up in different directions; secondly, as to the formation of a cavity and clefts in the homogeneous grains. The properties of starch granules above referred to, show that in such circumstances not a breaking but only an extending of the substance would take place, this causing the dense substance to become more watery and less refractive; for such places, therefore, where the tensions are strongest (viz., the central part of the grain and the middle parts of the peripheral dense layers after

their reaching a certain thickness by apposition growth), the transformation of less watery to more watery substance will be performed; in other words, the nucleus and the less dense layers will appear. That the inner parts of the grains, taken as a whole, are less watery than the peripheral ones, is due also to their being extended by the latter.

The unequal growth of starch-grains in different directions was shown in a former paper[1] to be due to the unequal conveyance of material. Starch-grains which are formed in the inner parts of chlorophyll or starch-forming granules, and remain surrounded by them, have central nuclei. They become eccentric when they are formed at the periphery of the chlorophyll or starch-forming granules, and show constantly the greatest growth where they are in contact with them.

The formation of compound grains was also described in the paper already quoted, and shown to be due to the growing together of free granules, and not, as Nägeli holds, to the division of simple grains. The development of half compound grains was investigated principally in the rhizome of Canna and found to be analogous. The structure of grains having their nuclei distant from each other, which led Nägeli to suppose an intense growing of the grains between them, is caused by their being formed at distant spots upon the periphery of the chlorophyll, or starch-forming granules. The differences in the density of simple grains and the partial grains of the half compound and compound ones, is due to the extension of the inner by the outer parts.

Nägeli, and after him most biologists, hold that starch-grains agree with protoplasm as to their molecular structure, and are to be considered as living bodies. There is no longer any reason for ascribing to them properties different from those of inert bodies; their cohesion and their optical properties prove conclusively that they are sphærocrystals; they differ from most crystals by their property of swelling up in water, but the so-called protein crystalloids, which agree with them in this property, are known to be crystals of proteic substances, and have been produced artificially under the same circumstances in which true crystals would have been formed.[2]—*A. F. W. Schimper, Johns Hopkins University.*

HARDINESS OF THE EUCALYPTUS.—The paragraph on p. 389 of the NATURALIST for May, requires qualification; what Baron Mueller no doubt said, was, that in the native places of growth the blue gum was uninjured sometimes when the thermometer fell to 20° or 15° Fahr. Luminose and hygrometrical conditions in connec-

[1] *Botanische Zeitung*, 1880. Translated in *Quarterly Journal of Microscopical Science*, April, 1881.

[2] These conclusions are based upon the researches of Schmiedeberg (*Zeitschrift für physiol. Chemie*, Vol. I), Drechsel (*Journal für praktische Chemie*, Vol XIX) and my own investigations (*Zeitschrift für Krystallographie*, Vol. V).

tion with thermometrical—indeed, all that we understand by the word climate, decide hardiness. In this case the *Eucalyptus globulus* will not stand even a white frost in many parts of the United States. In a letter to me Baron Mueller says that *Eucalyptus amygdalina* and *E. Gunnii* stand a much lower temperature in their own homes than the common blue gum, and are now being used to replace the celebrated plantations on the marshes near Rome, which were destroyed during the winter of 1879–80.—*Thomas Meehan.*

CURIOSITIES IN TREE GROWTH.—Some years since a gentleman in New Jersey pointed out to me what he thought to be a curious case of natural grafting. One of the boughs of a maple tree *(Acer rubrum)* had thrown off a branch which after growing to a length of several feet without branches, had again united with the parent bough, the two forming a smooth and perfect union. The matter was discussed among some friends distinguished alike in horticulture and botany, and it was decided that such a thing could not take place naturally. Recently a similar case has come to my notice in a tree whose location, in a remote portion of Arizona, places it almost beyond possibility that human agency could have been concerned. The tree is a variety of oak, common here, which no botanist seems at present willing to assign to any species.

As represented in figure 1, the bough forks at the point *a*, about three feet from the trunk. The two branches, after running nearly side by side for a distance of three feet, come together at

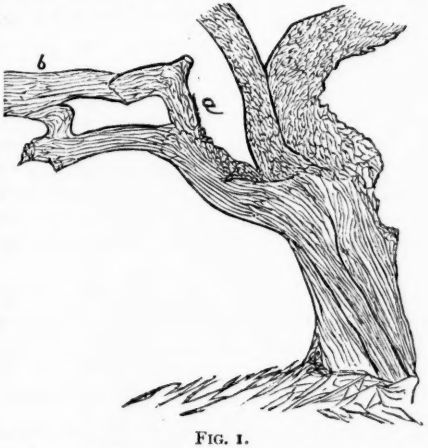

FIG. 1.

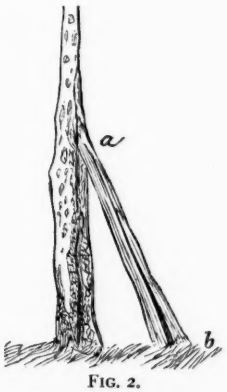

FIG. 2.

b, forming a smooth and perfect union. As the bough is dead and bared of its bark, the fibers of the wood can be seen with great distinctness. The "crotch" at *b* presents precisely the same

appearance that it would were the parent trunk toward *b*, forking in the direction of *a*. It is worthy of note that the bough beyond *b* has about the same diameter as inside of *a*, while at the branching part the wood is about equally divided between the two branches.

This interesting specimen has been forwarded to the Smithsonian Institution, where it may be seen.

Near this tree grows another, represented in figure 2, a specimen of *Platanus racemosa*, the sycamore of this section. Growing on the bank of the stream which runs through the bottom of a deep cañon, it seems to have been broken down by some of the rubbish carried against it during the rainy season. Breaking upon the upper side, a large mass of wood has been separated from the bark and protruded through the aperture. Later the tree has resumed the erect position. At the present time the entire cavity has been filled with new wood, and all traces of the wound bid fair to disappear. The mass of rubbish which has accumulated at the base of the tree gives the portion *a–b* the appearance of having been elongated.

Possibly such wounds are more readily healed in this country, owing to the irregularity and frequency of the periods of growth, corresponding to the great irregularity in the seasons of heat, cold, drouth and moisture.—*Henry H. Rusby.*

Botanical Notes.—The Characeæ of North and South America are now under a fair way to be elaborated systematically. Dr. T. F. Allen, of 10 E. 36th street, New York, who has already done such good work for some of our species, is making arrangements for enlarging the scheme of his *exsiccatæ* and illustrations so as to include the South American species. He requests all collectors to secure good specimens for him, and for those from South America he will make arrangements to pay liberally.——It is a genuine pleasure to call attention to the increasing usefulness of microscopical journals. The publishers of the *American Journal of Mircroscopy* deserve the thanks of students and teachers of botany for republishing, in the April number, a lecture on "How to examine a plant microscopically," by H. Pocklington (Leeds, Eng.). The article, which occupies eight pages, is a most excellent one, and cannot fail to do much good.——I. C. Martindale, of Camden, N. J., has issued a neat Catalogue of Desiderata (21 pp.), which may prove useful to other botanists also.——Professor Harvey's Classified list of the ferns of Arkansas, reprinted from the *Botanical Gazette*, enumerates thirty-nine species, and gives their range throughout the State.——Professor Dickson's paper on the morphology of the pitcher of *Cephalotus follicularis* in the *Journal of Botany* for May is interesting. He concludes "that the pitcher results from a calceolate pouching of the leaf-blade from its upper surface" somewhat as in the nectariferous petal of Aconitum, or as is shown better still in the petals of Aquilegia.

Incidentally he refers to the pitcher of Sarracenia as "corresponding morphologically to a peltate leaf like that of Nelumbium," but with the hollowed out depression of the upper surface much deepened and narrowed.——Morren's *Correspondance Botanique*, 8th edition, is a valuable aid to the botanical collector as well as the general botanist, giving as it does the address, title and special line of work of the more prominent botanists and collectors in all parts of the world.——We shall be doing a good service to many students by calling attention to the catalogue of works on natural history, just issued by Bernard Quaritch, 15 Piccadilly, London. Many rare and valuable botanical books are offered at moderate prices.——An important work, "Eléments de Botanique Fossile," by Edouard Bureau, is announced by the Paris booksellers as about ready.——Peter Henderson, well known for many years as a prominent horticulturist, has just published a "Handbook of Plants," which is designed to serve as a dictionary, or reference-book for the plants in cultivation either for use or ornament. It is especially adapted to this country, and is thus more valuable for Americans than Paxton's, Loudon's or Lindley's works. The arrangement is alphabetical for easy reference, but the natural order is indicated in every case. Instructions as to the best modes of cultivation are given in many cases, in addition to short descriptions of the plants. Not only will this book prove valuable to the horticulturist, but in many cases the botanist will find it indispensable also.

ZOÖLOGY.

THE KING SNAKE (OPHIBOLUS SAYI) SUPS ON A FULL GROWN WATER MOCCASIN (ANCISTRODON PISCIVORUS).—"Be ye therefore wise as serpents."—Matt. x, 16.

The non-venom-secreting Ophibolus and the deadly Ancistrodon had kept a friendly companionship for several days in the same prison box. Well aware of each other's peculiar method of self-defence, there had been a policy truce instituted for the nonce. The former did not relish a hypodermic injection of poison from his surgeon neighbor, and the latter equally as much dreaded a fraternal embrace from his acrobatic companion. The one abhorred convulsions and tetanoid calisthenics as much as the other deprecated triturated ribs and macerated scales. The sky became suddenly changed, and such a change! &c., *vide* Byron. Without warning, the king snake instantly whipped a coil or two of its tail around the neck of his neighbor, just as the cracker of a whip doubles into a knot by the movement of the staff in the hands of a deft coachman. Before the moccasin could recover from the shock, its entire body was tightly pressed by the reduplicating folds of its agile enemy. From neck to tail and back again, its entire length was tied up so effectually that respiration became difficult, movement of the body was out of

question excepting a vibrating tremor passing helplessly from nasal tip to tail tip, and a swift contracting of the assailant's convoluting folds assured the victim of broken ribs and speedy helplessness. The mouth of the moccasin was open, though the bifid tongue could not dart forth, the lower jaw hung livid, and the strength left in the upper maxillary was insufficient to allow the poison fangs to erect themselves. Suffocation and broken ribs were too much even for a deadly snake to withstand. These facts were closely noted by our acute Ophibolus who slowly uncoiled himself from the neck of the vanquished, and withdrawing his head a few inches so as to notice the features of his prey, he advanced for the banquet. The stunning blow being felt, the moccasin had closed his mouth and was apparently resigned to his fate. Fastening his upper teeth upon the occipitals, and distending his os quadratum, the king snake held the head of his victim in his mouth, the tail of the latter still wriggling uneasily. The coiling became tighter and tighter, a slight noise like the crackling of bones was heard, accompanied by a tremor which shook both alike, and the two, victor and vanquished, now twisted up in a labyrinthine knot, rolled over and over like a spent ball from a cannon.

Taking them from the box, I uncoiled and stretched them out on the floor where they appeared like a double tailed snake without a head. This gave relief to the moccasin who, although his head, as far as the atlas, was firmly held between the jaws of his antagonist, wriggled manfully with renewed strength obtained by a release from the constrictor's folds. The king snake was now at a disadvantage, as noted from the movements of his tail. A stick was placed near it, around which it was instantly coiled to the *extent* of six inches, and with this purchase power he felt at ease. The ribs of the moccasin were effectually crushed, and the process of swallowing him was now easier and more rapid. About sixteen inches of the victim's body being stored away in the expanding stomach of the happy constrictor, a quantity of chloroform was administered to the gourmand, and in this position the two specimens are now preserved in my cabinet.

The length of the king snake was forty-two inches, and that of the moccasin thirty-four inches, the body of the latter being much larger than that of the former. The time occupied in this halfway repast, was two hours.

Only a scientific consideration prompted me to destroy and dissect my useful cannibal, for he had already eaten seven other snakes while in captivity.

This note must be added. Ophiophagi, or snake eating snakes, prefer other victims, and prey on their own species only on account of the absence of their regular food.—*John T. Humphreys, Burke Co., N. C.*

Survival of Wild Habits in Domesticated Cattle.—One would suppose that Jersey cattle, which are probably the oldest domesticated breed, and which are noted for being such docile and gentle pets, had outgrown all traces of their wild habits; but I have frequently noticed some traits in my herd, which seem to me to be a survival of their wild habits away back in far distant times. For instance, in going to or returning from the pasture, the strongest cow or bull heads the procession, and the weakest or youngest calves bring up the rear. This order of movement is seldom varied, and it would seem to have been necessary for the protection of the weaker members of the herd in a wild state. Then, it often happens that those in the rear, as they are being driven to pasture, are lazy in their movements, and it is sometimes difficult to urge them along. But turn out and leave one or more such animals behind! They quickly find the use of their legs, and very soon gallop up to the herd, the protection of which they no doubt think they need. Choice grass and a good appetite are alike unavailing to keep them back when the herd is moving away! Again, they sometimes all take a notion to walk very slowly and linger by the way, even when much urged to go forward. At such times let a man come up behind them on a run, making a clattering noise with his feet, and without other effort the herd will prick up their ears and break into a trot. When moping over the ground, such a noise behind them will arouse them to life and movement at once. Horses act very much in the same manner when they suddenly hear the clattering of feet along the ground. It has seemed to me that in their wild state they must have learned that this noise indicated the near approach of danger, either from the apprehension of enemies, or from fright among their own associates, and that the habit has survived the necessities which called it into existence. Such peculiarities, though not specially important or noteworthy in themselves, would be more marked and decided in a wild state, and what we see now is but a faint trace of the alert habits of their old time predecessors.—*Chas. Aldrch, Webster City, Iowa, 1881.*

A Dog's Discrimination of Sounds.—My neighbor's dog, "Shep," used to stay at my place about as much as at home. He was of mixed blood—probably Newfoundland, shepherd and water spaniel—and very sagacious and tractable. A bridge crosses Boone river just below my residence, and below this bridge there are perhaps two hundred acres of timbered land, which is unin-closed and used for common pasturage. One of my cows wore a heavy deep-sounding bell, which could easily be heard a mile. Upon several occasions I sent "Shep" after the cows and he always brought them—and frequently after dark. My plan was to go and stand upon the high bridge and listen, keeping "Shep" close by my side. Upon catching the sound of our bell among

a dozen others, as it came up rather indistinctly through the trees, I would say: "There, 'Shep,' that is our bell; go and get the cows!" As soon as he seemed to feel sure of the sound he would start off upon a run, and it would be but a few minutes until I would hear the bell coming towards home. From many trials I satisfied myself that he could distinguish the sound of our bell as far as I could myself. He could doubtless have been trained to do many such tasks, but he had had little or no training of any kind, and this instance that I have stated seemed to have been understood by him as a matter of course, and had not come through any special effort or discipline.—*Chas. Aldrich, Webster City, Iowa, 1881.*

Discoveries in the Anatomy of Crustacea.—Herr. Nebeski in his contributions to our knowledge of the Amphipoda of the Adriatic,[1] adds considerably to our knowledge of the anatomy and histology of these forms. He first discusses the glands in the legs of certain forms first pointed out by Prof. Smith.[2] Next the urinary glands, which are found at the posterior portion of the alimentary tract are investigated. Following this comes an account of the structure of the gills and the rectum of Orchestia. The next point discussed is the fact that certain portions of the testes of Orchestia produces eggs, and our author says: "we have here in general (überhaupt) no hermaphrodite gland, but the organ corresponds *in toto* to the testes of the allied Amphipoda, and shows only the remarkable exception *that a definite portion of the genital layer produces eggs.*" The article concludes with a review of the Amphipod fauna of Trieste.—*J. S. Kingsley.*

Effects of different colored light on the growth of Animals.—Various persons have experimented upon the effects of different colored light upon the growth of animals, and have universally found that animals develop at different rates under the influence of the different colors. M. Yung in his recent investigations on the eggs of frogs, trout and Lymnæa,[3] found that they developed in the following order, the violet accelerating and the red retarding:

These two colors acted in nearly the same manner.	Violet.
	Blue.
	Yellow.
	White.
	Red.
	Green.

—*J. S. K.*

Zoological Notes.—The Proceedings of the United States National Museum, just issued, contain a check-list of duplicates

[1] Otmar Nebeski, Beiträge zur Kenntniss der Amphipoden der Adria. Arbeiten aus dem Zool. Inst. Wien, III, pp. 1–52. pls. 4, 1880.

[2] Tube building Amphipoda. *Am. Jour. Sci.*, III, VII, p. 601, 1874.

[3] De l'influence des lumières colorées sur le développement des animaux—Mittheilung Zool. Station Neapel, II, p. 233, 1880.

of fishes from the Pacific Coast of North America, distributed by the Smithsonian Institution, in behalf of the National Museum, to different college museums. These collections are of great value, comprising many rare typical forms, and will do much towards the progress of ichthyology. Valuable notes on the fishes of the Pacific coast by Messrs. Jordan and Gilbert appear in the same periodical.——Among ornithological papers in the signature of the same Proceedings, issued April 13, 1881, is the description of a duck, *Fuligula rufina* (Pallas), which is new to the United States, having been found in the New York market, and supposed to have been shot on Long Island sound.——From his extended observations on the food of the fresh-water fishes of Illinois, Mr. S. A. Forbes is impressed with the "supreme importance of Entomostraca and the minute aquatic larvæ of Diptera as food for nearly or quite all of our fresh-water fishes, a conclusion that gives these trivial and neglected creatures, of whose very existence the majority of people are scarcely aware, a prominent place among the most valuable animals of the State, for without them all our waters would be virtually depopulated." He also brings out the interesting conclusion that a prolific species having an abundant food supply, and itself the most important food of predaceous fishes, may, by extraordinary multiplication, so diminish the food of the young of the latter as to cause, through its own abundance, a serious diminution of the numbers of the very species which prey upon it. It is not certain that the excessive increase of the gizzard shad would, by eventually reducing the supply of Entomostraca, cause a corresponding reduction in the numbers of all the species of that stream by starvation of the young; and this decimation, applying to all in the same ratio, would take effect upon the ordinary number of the other species, but upon the extraordinary number of the gizzard shad, would reduce the other species below the usual limit, but might not even cut off the excess of the shad above that limit. Consequently, important as is the supply of food-fishes for the predaceous species, it is not less important that the predaceous species should be supplied to eat up the food.——The third volume of Dr. G. S. Brady's Monograph of the Copepod Crustacea of the British Islands, published by the Ray Society, has appeared. This valuable and fully illustrated work will be welcomed by those in the United States interested in the Entomostraca.——The Transactions of the Kansas Academy of Science, for 1879–80, just issued, contain some important faunal entomological lists by Prof. F. H. Snow, of Kansas, Colorado and New Mexico; articles on the Batrachian reptiles of Kansas, by F. W. Cragin; and notes on the birds of Riley county, Kansas, by Dr. Blachly.

ENTOMOLOGY.[1]

DIMORPHISM IN CYNIPIDÆ.—The first record in this country, if not elsewhere, of the actual proof of dimorphism in the Cynipidæ, was by the editor of this department, in the AMERICAN NATURALIST for 1873 (Vol. VII, p. 519), where the common wooly oak gall which produces in spring the bisexual *Cynips q-operator*, was shown to have a larger asexual dimorphic form (our *C. q-operatola)* that develops in an autumnal pip-like gall formed between the cupule and the fruit. Walsh had previously given good reasons for the belief that *C. q-aciculata* was the autumnal agamic dimorphous form of *C. q-spongifica (Am. Entomologist* II, p. 330, ff.), and Mr. H. F. Basset has, following Adler's interesting experiments in Europe, suggested the probable dimorphic connection of several of our vernal galls which produce bisexual individuals with autumnal forms which produce larger, asexual flies. Dr. Adler continues his successful study and experiment in this direction, and gives in the *Zeitschrift für wissens. Zool.* (Vol. XXXV, p. 151), the results obtained so far in his researches, and the number of species in which the occurrence of dimorphic forms has been proven is already quite considerable. The following is a list thereof, the name in the first column referring to the agamic, that in the second to the bisexual generation:

1.	*Neuroterus lenticularis*	=	*Spathegaster baccarum*
2.	" *læviusculus*	=	" *albipes*
3.	" *numismatis*	=	" *vesicatrix*
4.	" *fumipennis*	=	" *tricolor*
5.	*Aphilotrix radicis*	=	*Andricus noduli*
6.	" *sieboldi*	=	" *testaceipes*
7.	" *corticis*	=	" *gemmatus*
8.	" *globuli*	=	" *inflator*
9.	" *collaris*	=	" *curvator*
10.	" *fecundatrix*	=	" *pilosus*
11.	" *callidoma*	=	" *cirratus*
12.	" *malpighii*	=	" *nudus*
13.	" *autumnalis*	=	" *ramuli*
14.	*Dryophanta scutellaris*	=	*Spathegaster taschenbergii*
15.	" *longiventris*	=	" *similis*
16.	" *divisa*	=	" *verrucosus*
17.	*Biorhiza aptera*	=	*Teras terminalis*
18.	" *renum*	=	*Trigonaspis crustalis*
19.	*Neuroterus ostreus*	=	*Spathegaster aprilinus ?*

Of Nos. 1–13, the first form appears in March until May, the second in June until July, or in some species in August. In Nos. 15–19 the agamic generation appears from October until March, and the sexual generation in May until July. In No. 14 the first form appears in January until February, the second in May until June.

Very remarkable is the fact that in some closely allied species no alternate generation seem to occur. They are the following species: *Aphilotrix seminationis, marginalis, quadrilineatus* and *albopunctatus.*

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

BLEPHAROCERIDÆ.—The very interesting discovery, by Dr. Fritz Müller, of the earlier states of *Paltostoma torrentium*, has been followed in rapid succession by that of other Blepharocerid larvæ and pupæ in various parts of the globe, and it seems that most, if not all, species of Blepharoceridæ agree in the mode of development and in habit. Thus Dr. F. Brauer finds that pupæ from the mountain streams at Meran, Tirol, are closely allied to those of *Paltostoma torrentium*, and that they are, in all probability, those of *Blepharocera fasciata*. We have for some time had in our collection a number of pupæ which were found six or seven years ago in the month of June by Mr. H. G. Hubbard near Fitchburg, Mass., and which we at once recognized as of some species of Blepharocera, upon seeing a photograph of the figures by Fritz Müller in Dr. Hagen's possession. The pupæ occurred in a mountain stream on a flat rock over which ran swiftly a thin sheet of water. The surface of the rock was coated with the pupæ. Another species (*Liponeura brevirostris* Löw) has been described in the larva and pupa states by H. Dewitz in the Berlin *Entomologische Zeitschrift* (Vol. xxv, p. 61–66). The latest contribution to the natural history of these interesting Diptera we owe to Dr. A. Wierzejski of the University of Krakau, who gives in the *Zoologischer Anzeiger* (No. 81, p. 212–216) full descriptions of the larva and pupa of another Blepharocerid. He found them in a mountain brook in the Tatra mountains, adhering to the rocks in the swiftest part of the current. The larvæ are able, by means of the six suctorial disks on the ventral side not only to withstand the swift current but also to move freely about, usually sidewise. Dr. W. did not succeed in rearing the perfect insect, as the larvæ and pupæ soon perished when confined in standing water; but from examination of the pupæ he is confident that his species is very nearly allied to *Blepharocera fasciata*. He promises further investigation of the subject, and especially on that most interesting discovery made by Dr. Fritz Müller, viz: the occurrence of dimorphic females in the species of Itajahi, the two forms of the female widely differing from each other in the organs of the mouth, the size of the eyes and the structure of the last tarsal joint. Dr. Müller's full paper on the metamorphosis of *Paltostoma torrentium* and the anatomy of its larva will be shortly published in the "Archivos do Museu Nacional do Rio de Janeiro."

For those not familiar with the descriptions already given of the larvæ and pupæ of this interesting group of Diptera we would add that the larva is one of the most remarkable in the insect world. It has apparently but six joints to the body, and its general appearance recalls that of *Asellus*, the joints being, however, deeply cut on the sides and widely separated. The six-jointed character is, however, only apparent, as the last joint is evidently composed of three, and the first joint is also evidently composed

of several, the head being distinctly separated beneath. The sides of the joints appear tuberculous and each joint has, indeed, a pair of separate, decurved, cylindrical and pointed tubercles issuing from it, resembling six pairs of legs, and used doubtless to lift the larva from its attachment when movement is desired. Medio-ventrally there is a series of six circular, elevated sucking disks, each having a series of tracheal filaments on the side, which filaments also doubtless aid in suction. The pupa is very flat ventrally, convex dorsally, with two conical horns on the anterior end, each composed of four compressed laminæ, which easily separate, and which are the thoracic tracheæ, corresponding to those of other aquatic dipterous pupæ, as in the common mosquito. The pupæ collected in Massachusetts are somewhat smaller than Fritz Müller's specimens, but structurally identical. They strongly recall in color and general appearance some of our smaller Gyrinid beetles.

Braula cœca not Particularly Injurious to the Honey Bee.—Mr. J. Fedarb has in Hardwicke's *Science Gossip* for May 2, 1881, an article on *Braula cœca*, that curious dipterous parasite of our honey bee. He asserts that there can be no doubt that the damage done by it is generally overestimated, and that the ravages of other hidden guests within the apiary are often wrongly attributed to Braula, the real authors of the mischief being overlooked. Braula is no doubt annoying to the bee it infests, but only when it occurs in very great numbers has it an injurious effect on the bee colony. Mr. Fedarb finds that Braula was unknown to the ancient authors on the honey bee, while even such careful observers of a more recent time as Swammerdam and Huber do not mention it at all. The parasite may have only lately developed the habit of living on the honey bee, being present formerly under other conditions, or it may have spread recently from some restricted point of the globe.

Economic Entomology in England.—Miss L. A. Ormerod's "Notes of Observations of Injurious Insects" for the year 1880 has been kindly sent us by the authoress. Of the numerous instances of insect injury during that year in Great Britain, none is more remarkable than that of the wide-spread damage caused by various species of Tipulid larvæ to wheat, barley, oats, cabbage, potatoes, peas and strawberries. The larvæ gnaw away the outer part of the plant just at the surface of the ground or a little beneath it, thus weakening or in many instances killing the plants. Tipulid larvæ are very plentiful in many parts of our own country, and occasionally inflict some damage to rich meadows, but no case of injury to field and garden crops has so far been reported to us. Miss Ormerod is doing an admirable work, and we are glad to see that she is meeting with success and encouragement.

THE CULTIVATION OF PYRETHRUM AND MANUFACTURE OF THE POWDER.—In accordance with an announcement in the March number of the NATURALIST, the editor of this department has sent out the seed of two species of Pyrethrum, viz: *P. roseum* and *P. cinerariæfolium*, to a large number of correspondents in different parts of North America. Every mail brings us some inquiries for further particulars and directions to guide in the cultivation of the plant and preparation of the powder. We have concluded, therefore, that such information as is obtainable on these heads will prove of public interest, and we shall ask Professor Bessey's pardon for trenching somewhat on his domain.

There are very few data at hand concerning the discovery of the insecticide properties of Pyrethrum. The powder has been in use for many years in Asiatic countries south of the Caucasus mountains. It was sold at a high price by the inhabitants, who successfully kept its nature a secret until the beginning of this century, when an Armenian merchant, Mr. Jumtikoff, learned that the powder was obtained from the dried and pulverized flower-heads of certain species of Pyrethrum growing abundantly in the mountain region of what is now known as the Russian province of Transcaucasia. The son of Mr. Jumtikoff began the manufacture of the article on a large scale in 1828, after which year the Pyrethrum industry steadily grew, until to-day the export of the dried flower-heads represents an important item in the revenue of those countries.

Still less seems to be known of the discovery and history of the Dalmatian species of Pyrethrum *(P. cinerariæfolium)*, but it is probable that its history is very similar to that of the Asiatic species. At the present time the Pyrethrum flowers are considered by far the most valuable product of the soil of Dalmatia.

There is also very little information published regarding either the mode of growth or the cultivation of Pyrethrum plants in their native home. As to the Caucasian species we have reasons to believe that they are not cultivated, at least not at the present time, statements to the contrary notwithstanding.[1] The well-known Dr. Gustav Radde, director of the Imperial Museum of Natural History at Tiflis, Transcaucasia, who is the highest living authority on everything pertaining to the natural history of that region, wrote us recently as follows: "The only species of its genus, *Pyrethrum roseum*, which gives a good, effective insect powder, is nowhere cultivated, but grows wild in the basal-alpine zone of our mountains at an altitude of from 6000 to 8000 feet." From this it appears that this species, at least, is not cultivated in its native home, and Dr. Radde's statement is corroborated by a communication of Mr. S. M. Hutton, Vice-Consul General of the U. S. at Moscow, Russia, to whom we applied for seed of this species. He writes that his agents were not able to get more than about half a pound

[1] Report Comm. of Patents, 1857, Agriculture, p. 130.

of the seed from any one person. From this statement it may be inferred that the seeds have to be gathered from the wild and not from the cultivated plants.

As to the Dalmatian plant it is also said to be cultivated in its native home, but we can get no definite information on this score, owing to the fact that the inhabitants are very unwilling to give any information regarding a plant the product of which they wish to monopolize. For similar reasons we have found great difficulty in obtaining even small quantities of the seed of *P. cinerariæfolium* that was not baked or in other ways tampered with to prevent germination. Indeed, the people are so jealous of their plant that to send the seed out of the country becomes a serious matter, in which life is risked. The seed of *Pyrethrum roseum* is obtained with less difficulty, at least in small quantities, and it has even become an article of commerce, several nurserymen here, as well as in Europe, advertising it in their catalogues. The species has been successfully grown as a garden plant for its pale rose or bright pink flower-rays. Mr. Thomas Meehan, of Germantown, Pa., writes us: "I have had a plant of *Pyrethrum roseum* in my herbaceous garden for many years past, and it holds its own without any care much better than many other things. I should say from this experience that it was a plant which will very easily accommodate itself to culture anywhere in the United States." Peter Henderson, of New York, another well-known and experienced nurseryman, writes: "I have grown the plant and its varieties for ten years. It is of the easiest cultivation, either by seeds or divisions. It now ramifies into a great variety of all shades, from white to deep crimson, double and single, perfectly hardy here, and I think likely to be nearly everywhere on this continent." Dr. James C. Neal, of Archer, Fla., has also successfully grown *P. roseum* and many varieties thereof, and other correspondents report similar favorable experience. None of them have found a special mode of cultivation necessary. In 1856 Mr. C. Willemot made a serious attempt to introduce and cultivate the plant[1] on a large scale in France. As his account of the cultivation of Pyrethrum is the best we know of we quote here his experience in full, with but few slight omissions: "The soil best adapted to its culture should be composed of a pure ground, somewhat siliceous and dry. Moisture and the presence of clay is injurious, the plant being extremely sensitive to an excess of water, and would in such case immediately perish. A southern exposure is the most favorable. The best time for putting the seeds in the ground is from March to April. It can be done even in the month of February if the weather will permit it. After the soil has been prepared and the

[1] Mr. Willemot calls his plant *Pyrèthre du caucase* (*P. Willemoti* Duchartre), but it is more than probable that this is only a synonym of *P. roseum*. We have drawn liberally from Mr. Willemot's paper on the subject, a translation of which may be found in the Report of the Commissioner of Patents for the year 1861, Agriculture, pp. 223–331.

seeds are sown they are covered by a stratum of ground mixed with some vegetable mould, when the roller is slightly applied to it. Every five or six days the watering is to be renewed, in order to facilitate the germination. At the end of about thirty or forty days the young plants make their appearance, and as soon as they have gained strength enough they are transplanted at a distance of about six inches from each other. Three months after this operation they are transplanted again at a distance of from fourteen to twenty inches, according to their strength. Each transplantation requires, of course, a new watering, which, however, should only be moderately applied. The blossoming of the Pyrethrum commences the second year, toward the end of May, and continues to the end of September." Mr. Willemot also states that the plant is very little sensitive to cold, and needs no shelter, even during severe winters.

The above-quoted directions have reference to the climate of France, and as the cultivation of the plant in many parts of North America is yet an experiment, a great deal of independent judgment must be used. The plants should be treated in the same manner as the ordinary Asters of the garden or other perennial Compositæ.

As to the Dalmatian plant, it is well known that Mr. G. N. Milco, a native of Dalmatia, has of late years successfully cultivated *Pyrethrum cinerariæfolium* near Stockton, Cal., and the powder from the California-grown plants to which Mr. Milco has given the name of "Buhach" retains all the insecticide qualities and is far superior to most of the imported powder as we know from experience. Mr. Milco gives the following advice about planting—advice which applies more particularly to the Pacific coast: "Prepare a small bed of fine, loose, sandy, loamy soil, slightly mixed with fine manure. Mix the seed with dry sand and sow carefully on top of the bed. Then with a common rake disturb the surface of the ground half an inch in depth. Sprinkle the bed every evening until sprouted; too much water will cause injury. After it is well sprouted, watering twice a week is sufficient. When about a month old, weed carefully. They should be transplanted to loamy soil during the rainy season of winter or spring."

Our own experience with *P. roseum* as well as *P. cinerariæfolium* in Washington, D. C., has been so far quite satisfactory. Some that we planted last year in the fall came up quite well in the spring and will perhaps bloom the present year. The plants from sound seed which we planted this spring are also doing finely, and as the soil is a rather stiff clay and the rains have been many and heavy, we conclude that Mr. Willemot has overstated the delicacy of the plants.

In regard to manufacturing the powder, the flower heads should be gathered during fine weather when they are about to

open, or at the time when fertilization takes place, as the essential oil that gives the insecticide qualities reaches, at this time, its greatest development. When the blossoming has ceased the stalks may be cut within about four inches from the ground and utilized, being ground and mixed with the flowers in the proportion of one third of their weight. Great care must be taken not to expose the flowers to moisture, or the rays of the sun, or still less to artificial heat. They should be dried under cover and hermetically closed up in sacs or other vessels to prevent untimely pulverization. The finer the flower-heads are pulverized the more effectually the powder acts and the more economical is its use. Proper pulverization in large quantities is best done by those who make a business of it and have special mill facilities. Lehn & Fink, of New York, have furnished us with the most satisfactory powder. For his own use the farmer can pulverize smaller quantities by the simple method of pounding the flowers in a mortar. It is necessary that the mortar be closed, and a piece of leather through which the pestle moves, such as is generally used in pulverizing pharmaceutic substances in a laboratory, will answer. The quantity to be pulverized should not exceed one pound at a time, thus avoiding too high a degree of heat, which would be injurious to the quality of the powder. The pulverization being deemed sufficient, the substance is sifted through a silk sieve, and then the remainder, with a new addition of flowers, is put in the mortar and pulverized again.

The best vessels for keeping the powder are fruit jars with patent covers or any other perfectly tight glass vessel or tin box.

In the next number we will give some account of the different ways in which the powder may be used to destroy insects.

Trees attractive to Butterflies.—Mrs. A. E. Bush, of San José, Cal., writes: "I have been to Monterey, and was fortunate enough to see the 'butterfly tree,' or trees, as there are three of them. These trees are the Monterey pine (*Pinus insignis* Dougl.), and are probably over one and a half feet in diameter, and completely covered with live butterflies. To say that there were as many butterflies as leaves upon the trees would not be a very great exaggeration. I saw them in the morning when it was cool and they could not fly very well, and picked up a dozen from the grass in a few seconds. A lady resident informed me that for the twelve years she had lived there the appearance had been the same."

Hudson bay Lepidoptera.—Mr. J. Jenner Weir, in the May number of the *Entomologist* (London, England), has an article on the Lepidoptera Rhopalocera of Hudson's bay, drawn from specimens obtained in two years' collecting in that dreary region by Mr. Walton Haydon. There are seventeen species of butterflies belonging to ten genera, all the genera but one occurring in Great Britain. The list includes *Vanessa antiopa*, *Pyrameis car-*

dui, P. atalanta, Pieris oleracea, Argynnis atlantis, A. myrina, Vanessa milberti, Grapta faunus, Lycæna lucia, Colias erytheme, var., *keewaydin, Argynnis lapponica, A. tarquinius, A. bellona, Papilio glaucus* var. *turnus, Limenitis arthemis* var. *lamina*, and *Phyciodes tharos*. Mr. Weir concludes his paper with the following remarks: "The collection of which I have now given a description, small as it is, is not wanting in interest. It is surprising to contemplate the time which must have elapsed since the three identical with European species had a common ancestor, and yet the difference now existing is too slight to consider them even varieties of each other. A former connection with Europe by the Faröe islands, Iceland and Greenland no doubt existed, and during one of the periods of mild Arctic climate the transmission of species from one continent to another was effected. We are so in the habit of calling this hemisphere the old world, that it does not occur to us that it is just as likely that *Vanessa antiopa* passed from America to Europe, as that the converse was the case."

Unfortunately the three species referred to *(Vanessa antiopa, Pyrameis cardui* and *P. atalanta)* are the very poorest that could be chosen as indicating length of time required for variation of forms that have become separated by wide expanse of ocean. They are cosmopolitan butterflies, all known to be capable of extended flight, and it seems to us that the constancy they exhibit in different quarters of the globe is explicable rather on frequent and recent migration from one part of the world to another.

Trade in Insects.—It is a well known fact that sixty or more years ago exorbitant prices were paid for rare insects, or at least for species that were considered rare. Since that time the market price for insects has been constantly on the decline, and at the present time a vast number of species of the two favorite orders, Lepidoptera and Coleoptera, can be had through reliable dealers at very reasonable prices, and generally correctly determined. Still there are some exceptions to this rule, and a recent auction sale in London of the collection of the late J. Aspinwall Turner, M.P., shows that the price commanded by the gorgeous species of the Goliath beetles is scarcely inferior to that paid by collectors in the days of Drury and Donovan. The following are some of the prices obtained at that auction sale: lot 61, 2 *Euchirus dupontianus*, 2 *E. macleayi*, 3 *E. cantori* and 3 *E. hardwickii* brought £8; lot 91, 2 *Goliathus giganteus* £7; lot 92, 1 *Goliathus giganteus*, 1 *G. kirkii* and 1 var.? *G. cacicus* ♀ £20; 1 *Ischnoscelis dohrni* £10; one pair of *Goliathus fornassinii* £24. It might be mentioned in this connection that at the beginning of this century Donovan paid for 1 *Goliathus giganteus* the handsome sum of 12½ guineas.

Ants Injurious in Arizona.—Mr. H. H. Rusby, of Clifton, Arizona, sends us a rather doleful account of the destruction wrought by ants in that Territory. He says the country is one vast ant colony, and that the ants prove the greatest drawback to

successful agriculture in the more arable portions. Several species seem to be thus troublesome, and until they are better known and the habits of the different species studied, it will be impossible to suggest a rational mode of warfare against them.

LARVÆ OF COLEOPTERA.—Professor F. G. Schaupp continues, in the Bulletin of the Brooklyn Entomological Society, his descriptions of larvæ of Coleoptera. In No. 10, Vol. III, of said Bulletin, he gives a plate with illustrations representing the larvæ of *Platynus extensicollis*, *Chlænius leucoscelis*, *Pterostichus lucublandus*, *P. mutus* and *Staphylinus vulpinus*.

COVERING OF EGG-PUNCTURE MISTAKEN FOR DORTHESIA.—In hastily looking over the collection of the late Dr. Fitch recently, we were somewhat amused to recognize the white and ribbed waxy material covering the egg-punctures of *Enchophyllum binotatum* labeled as *Dorthesia viburni* and *D. celastri*. This covering does bear a superficial resemblance to the exudations of Dorthesia, though a glance suffices to show that it has no structure connected with it. We cannot find that any such species of Dorthesia were described by Fitch, though Glover refers to his *D. celastri* as found on Celastrus (Agricultural Report, 1876, p. 45). Mr. Lintner, the present State entomologist of New York, thinks that the species may possibly have been published in fugitive articles in the *Country Gentleman*, but we have no means of ascertaining the facts.

MR. H. KEENAN, of Quaker City, Ohio, sends us the saw-fly, *Dolerus unicolor* (Beauv.), the ♀ of which is described as *arvensis* by Say, with a statement of its injuries to the fruit buds of pear trees by eating holes therein, the saw-flies occurring in vast numbers around the trees. This is the first case that has come to our knowledge of a Tenthredinid in the imago state injuring vegetation, and it is possible that some other insect may have been the real depredator.

SUPPOSED ARMY WORM IN NEW YORK AND OTHER EASTERN STATES.—Numerous accounts have been published in the daily and weekly journals of the East, announcing wide-spread injury by the "army worm." This injury has occurred in New Jersey, on Long Island and in most of the grazing sections of New York, especially in St. Lawrence, Franklin, Jefferson, Oswego and Hamilton counties. Professor J. A. Lintner, State Entomologist of New York, has published the fullest account of its ravages in the Albany papers, which have been quoted in the *Country Gentleman*. Mr. J. Q. Adams, of Watertown, N. Y., writes to us under date of May 24th, as follows:

"Many hill pastures hereabouts are being ruined by what is called the army worm and while I cannot doubt but that it is *Leucania unipuncta* from its work, still I wish confirmation of the fact by an authority. My search in the fields has developed only a black headed, black spotted, smoky colored, naked worm that builds a nidus of its

own chips, which are pure green, and lives either close upon or below the surface of the soil. I know what the mature army worm is like from my books, but I find no mention of the immature larvæ. If you will favor me with a line or pamphlet describing the immature worm, you will help me out of the dilemma. Doubts suggest themselves because of the silken nidus which seems to me inconsistent with migratory habits.

The work of the pests, which I suppose has been checked the past week by the heavy rains we have had, is already considerable, some fields as large as forty acres being ruined and others showing only dead spots of a rod or two square. It is confined to the limestone ridges and to pastures. Are all our other pastures in danger? This is a dairy country and great harm will result if the work continues."

There seems to have been considerable doubt as to whether these worms were the true army worm or not. From specimens that were forwarded to us by Mr. Lintner and Mr. Adams, it would seem that there are two different species concerned in the work. The principal and larger one is the larva of *Nephelodes violans* Guen. We have known the insect since 1871, and it is tolerably common all over the eastern portion of the country. Walsh refers to it in an unpublished note as being found in meadows under stones at Rock Island, Ill. We have found it on a number of occasions since 1871 in different parts of Illinois and Missouri, usually hiding under planks or stones or cow dung in meadows, but occasionally feeding some distance up on a grass stalk, even in the hot sun. When at rest it is usually curled sidewise and surrounded with its frass which is of a bright green color. The larva is one of our largest cut-worms, distinguished from all others by the pale amber-colored head and the bronzy hue of the body; the pale dorsal and sub-dorsal stripes always showing distinctly on the dark, highly polished cervical and anal plates. It is referred to by Mr. G. H. French, of Carbondale, Ill., in the *Prairie Farmer* for April, 1878, and also in Professor Thomas's 2d Report on the Insects of Illinois (7th State Report, for 1877), pp. 99 and 220. We have also referred to it as taken from the stomach of a blue-bird, in the *American Entomologist* Vol. III, p. 205. The larva is found of various sizes in the early spring, some being so large as to prove hibernation in this state, larval hibernation being further established by the occurrence of the specimen in the stomach of a blue bird shot in March, and by our having dug it up in a semi-torpid state last February in Virginia. The species may also hibernate, however, in the imago state, in which it is frequently captured in the winter, especially in the Southern States. The very young larvæ are bright-green with indications of the stripes which characterize the full-grown larva. The eggs have not yet been discovered. Pupation takes place in a naked cell just beneath the surface, and not till June or thereafter even in Missouri, the moth issuing in the autumn.

The wide-spread appearance and injury of the species the present spring, furnishes an excellent illustration of the fact, that species which have never before been looked upon as injurious to agriculture may suddenly become so. The insect has various parasites.

We notice that Mr. Lintner, disregarding the popular name of "bronzy cut-worm," by which we have characterized the larva, proposes to call it the "grass-cutter," on the plea that the term "worm" is, strictly speaking, used for the class Vermes, and should be discarded from entomological nomenclature as applying to larvæ. Such ultra-refined reasoning, could it have any following, would lead to absurd ends. Vulgar names rarely become popular except as they come from the people, and should, when coined by naturalists, be as far as possible specific of some peculiarity that will permit recognition of the object. The term "grass-cutter" is a general one that would equally fit the army worm, the Pyralid larva referred to by Mr. Adams, and dozens of other Noctuid larvæ which are "grass-cutters" and to which the term "cut-worm" has been aptly applied. The term "worm," in the entomological sense, comes from the people and is universally employed by English writers, while its equivalent is employed in the same sense in French, German and other languages. To undertake to eliminate it from the vernacular is to attempt an innovation which will meet with deserved failure, and the impossibility of doing which Mr. Lintner concedes in his necessary use of the terms "army worm," "apple worm," "cabbage worm," etc.

The second worm is a much smaller larva of a dingy color, with large piliferous spots, and evidently belonging to the Pyralidæ. We have also in past years found it in Missouri in pastures, mostly under cow dung, but have not yet reared it to the imago state. It evidently played a considerable part in the injury referred to by Mr. Lintner, and was more common than the Nephelodes in the fields referred to by Mr. Adams. It forms, for transformation, among the grass roots, an elongate pod of silk intermixed and covered on the outside with earth.

Without having seen the specimens it would have been safe to conclude that the reported injury was not from the true army worm, which nevers appears, in destructive numbers, so early in the season in the northern part of New York, and Professor Lintner was rightly led by this reasoning to doubt whether it was that species. So far as we can learn, the Nephelodes larvæ have shown no propensity to travel from field to field as does the true army worm. They will soon disappear, from death or through transformation, and are not likely to attract any further attention the present season. Most of the remedies recommended for the army worm will apply to the Nephelodes larva, a full description of which we append from our notes, in order that it may be distinguished from the *Leucania unipunctata*, the larval changes of which are described in our 8th Mo. Report, pp. 184–5.

NEPHELODES VIOLANS—*Larva:* Larger specimens fully 1.9 inch long, largest in middle of body and tapering slightly each way, especially toward anus. Color brownish bronze, the surface faintly corrugulate but polished, the piliferous spots obsolete. A darker, highly polished cervical shield and anal plate. A medio-dorsal and sub-

dorsal stripe of a buff, or dull flesh color, each stripe of about equal diameter, (nearly 0.04 inch on middle joints) forming narrower, paler lines on the plates and nearly converging on the anal plate; a similar but somewhat broader substigmatal stripe which is wavy below; between sub-dorsal and stigmatal stripes a faintly indicated pale line dividing the space nearly equally. Venter nearly of same buff color, with a tinge of green. *Head* perpendicular, immaculate, paler than body, rugulose, sub-polished, faintly translucent, pale dingy-olive, the jaws, and sometimes the mouth-parts, darker. Legs and prolegs of same pale olive color, the latter with a black band at outer base. Stigmata black.

The young larva is green but early shows the pale stripes. When about one third grown the general hue is olive-green with the cervical and anal plates but little darker. The head is pale, greenish, faintly freckled and with a few dark hairs; the sutures pale, the mandibles tinged with blood-red and brown at extremeties, and the ocelli distinct on a pale ground, the second and third from below, black, the others light. The three dorsal stripes and the narrower supra-stigmal line are very pale, greenish-yellow, the broader sub-stigmatal stripe of a clearer cream-yellow with a faint carneous tint.

One of the most marked Noctuid larvæ, at once distinguished from all others known to me when full grown by the pale, immaculate head (recalling coral) and the polished, bronzy or umber color of body. The upper stripes are often obsolete or subobsolete in the middle of body, but are persistent on the plates. The bronzy color in paler specimens is due to brown and yellow mottlings, and in dark specimens becomes nearly black; while the stripes are generally minutely mottled with carneous.

Pupa—Normal, dark brown, the tip with two horizontal almost parallel spines.

MIGRATION OF BUTTERFLIES.—Under date of June 2, Dr. J. H. Mellichamp, of Bluffton, S. C., sends the following interesting account of the migration of a butterfly, the species being *Pieris monuste* L., a tolerably common insect in the South. The larva, according to authors, feeds on *Cleome pentaphylla*, and Mr. E. A. Schwarz found it in Texas on *Polanisia trachysperma*. It is colored with faint violet and with citron-yellow stripe, the head, legs and venter being greenish-yellow, both head and body being spotted with black piliferous tubercles, the larger ones in four rows. The chrysalis is pale yellowish, spotted and shaded with brown, and characterized by two black filamentous spines on the middle of the body (fourth abdominal joint). Dr. M. says:

"I enclose specimens of a white butterfly, thousands of which have been steadily passing over this place from west to east (apparently against the wind) both yesterday and to-day. Savannah (Ga.) is west or south west of this place, and I am informed that oats had been destroyed there some two or three weeks ago by a caterpillar. Can this stranger be the parent of the same? Being white, they can be seen at a long distance, and they come along in twos, and threes, and fours and sometimes in a greater number—going steadily east or north-east—seldom stopping ("so hasty" as a darkey would say!), but occasionally alighting on a weed, or shrub, or flower (Gardenia).

Usually they fly at the distance of fifteen or twenty feet from the earth. Most are white, and larger, I think, than the enclosed; a few are darker, like this other specimen. They are shy and wary and very difficult to capture. A colored man said to me that they came in his field "like a swarm of bees," and that he "just couldn't stand it any longer—never saw such a thing in my life,"—and so dropped his hoe and came home!!

CLASSIFICATION OF THE MITES.—In a recent letter Dr. G. Haller, of Bern, Switzerland, already well known through his studies of the Acarina, informs us that, after a great number of examinations, he finds that these curious creatures have not only three pairs of maxillæ and a true labium with palpi, but, as is already

known, two pairs of abdominal, as well as cephalothoracic, legs. He does not consider that they belong to the Arachnida, with which they have been hitherto placed, but that they are much more nearly allied to the Crustacea, from which they differ, of course, in breathing through tracheæ instead of gills. He believes they must form a fifth class of Arthropods equivalent to Crustacea, Myriapoda, Arachnida and Hexapoda.

CARRYING OUT THE LAW.—The British Parliament passed, in 1877, an act providing for the imposition of a fine for the person who should import living specimens of the Colorado potato-beetle. That this act did not remain an empty letter is proven by the following case: In February of this year it came to the knowledge of the authorities that a man in Devonshire had in his possession living specimens of the Doryphora, which he had brought over from America, and which he refused to give up. The man was immediately tried, convicted and fined £5, notwithstanding he proved that he had meanwhile killed the beetles. The Devonshire farmers are said to be much dissatisfied at the small amount of the fine, the maximum penalty fixed by law being £10.

LOCUSTS IN MEXICO IN 1880.—We are indebted to Dr. E. Palmer, for the following data concerning the appearances of locusts of unknown species in Mexico last autumn. They appeared during October at Chihuahua, at Saltillo and at Parras. At Saltillo they attacked the winter wheat, which was sufficiently advanced to be injured by them.—*A. S. Packard, Jr.*

ERRATUM.—A rather annoying error crept into the article on Cicada in the last number. On page 481, line fourteen, from bottom, "1860" should be "1660," that being the year of the last simultaneous appearance of the two broods that appear this year.

ANTHROPOLOGY.[1]

ARCHÆOLOGICAL RESEARCHES IN NICARAGUA.—Number 383 of the Smithsonian Contributions is an important addition to our knowledge of Ancient America, entitled "Archæological Researches in Nicaragua," By J. F. Bransford, M. D., Passed Assistant Surgeon, U. S. Navy. Washington City: Published by the Smithsonian Institution, 1881." Dr Bransford made three journeys to Nicaragua, one in 1872, with Commander E. P. Lull, a second in 1876, when several months were spent in archæological explorations, and a third in 1877, at which time the author's investigations were extended to Nicoya, in Costa Rica. Excepting the last named excursions, all the excavations were made on the Island of Ometepec, and to a slight extent near San Jorge on the mainland.

The geology and natural scenery of the island, the lake, and the surrounding country, are so graphically described that the

[1] Edited by Prof. OTIS T. MASON, Columbian College, Washington, D. C.

reader will have no trouble in following the narrative and in catching the relation between the sites explored and their environment. The hacienda of Don José Angel Luna having been placed at the author's disposal in 1876, most of the work was done in that vicinity. To reach the burial vessels it was necessary to dig down through a layer of light ash and volcanic cinder, a second of old lava much decomposed, a third of gritty ash, to the fourth, of black sand similar to that now forming the neighboring beach. Pottery, beads, shells, human bones, etc., the necessary concomitants of such a site, were found in abundance. The great interest of the exploration, however, and the *raison d'être* of the book are the burials jars, some globose, others with wide flaring mouths, but the greater number belonging to the unique shoe-shaped burial urns of coarse red material, over the mouth of which were placed delicate bowls of thin yellow ware elaborately painted.

To the description of the covers which are called Luna ware, especially to the elucidation of the designs upon the exterior and the interior surface, Dr. Bransford gives the greatest attention. It is very much to be regretted that his artist is so far behind him; indeed, in a few instances, has omitted from the drawing the very features alluded to in the text. It is a grave fault of nearly all who attempt to illustrate savage technique that things are represented more regular and beautiful than they really are. In this instance, however, the picture falls very far beneath the reality. The two plates of photolithographs at the end are worse still, the objects seeming to be blurred and out of focus.

On page 15-19 will be found a detailed list of the burial urns, giving their shape, the width and depth of both jar and cap, and the position and the contents of each. The author, after reviewing what has been said concerning the origin of the shape of these unique objects, inclines strongly to the view that they are rude representations of birds. Stone graves similar to those of Tennessee, and mounds also, occur in the locality examined. Stone images already made familiar to us by Stephens and Squier, and rock carvings form the closing pages of the chapters devoted to Ometepec. Chapter III relates to Palmar, on the mainland, in the department of Rivas, north-west of San Jorge; Managua; San Juan del Sur; and a pottery manufactory near San Jorge. Chapter IV gives a description of Nicoya and an enumeration of objects in greenstone. The concluding chapter is devoted to the historical relations of the tribes formerly inhabiting the region, beginning with the Aztec tribes of the conquest and working back to the people of the shoe-shaped burial jars, "more closely connected with the South Americans than with Nahuas and Mayas of Mexico and Guatemala."

The volume closes with a minute list of Dr. Bransford's collection, giving over 1500 entries.

WILD RICE IN EUROPE.—The *Zizania aquatica*, or wild rice, grows very extensively in many parts of the United States, and being a wholesome food-plant, has been, and is still one of the most important food articles of the Indians of the Mississippi plains. The Menomonees are named after it and were formerly called by the French "Folles Avoines."

Many fruitless attempts have been made to introduce this plant into Europe; but the seeds had arrived in a too desiccated condition. Lately M. Villmorin sent fresh grains over to France packed in a box filled with wet moss, and the recipient Count Hyacinthe de Charencey, at St. Maurice les Charencey, Department of the Orne, placing them in a morass, or swamp, had the satisfaction of seeing them sprouting. They soon arrived at maturity, and thus the beginning is made of transplanting this important food-plant into a climate which may prove just as congenial to it as that of the American swamps, where we see it growing in such great profusion.—*Albert S. Gatschet.*

NORSE MYTHOLOGY.—The traveler in Switzerland passing from one village to another finds himself ever and anon at the foot of a glacier, where he beholds in the weird cathedral outlines the crystallized remains of the soft and plastic snow,—in its high mountain origin so homogeneous and so circumscribed, in its terminations so widely separated and so strongly individualized. The same is true of the world's mythologies, all having their origin in the sensitive spirit of man as it ponders over and reaches after the unseen cause of all phenomena, but transformed into distinct systems through the laws of nature and the influence of circumstance. The comparison of these various resultant forms constitutes one of the most valuable chapters in anthropology. It is impossible to attempt a scientific classification, much less to make reliable deductions, until all the descriptions are in. We are indebted to S. C. Griggs & Co., of Chicago, for the third edition of a volume upon Norse mythology, by Prof. R. B. Anderson. The introductory portion of the work, though written in a style of glowing enthusiasm, does not please us so much as parts I, II and III, relating to the creation and preservation of the world, the life and exploits of the gods, and Ragnarak, or destruction and regeneration. The three sections are dedicated to Urd (was), Verdando (is), Skuld (shall be).

The chief depositories of the Norse mythology are the Elder or Saemund Edda (poetry) and the Younger or Snorre's Edda (prose). The former consists of thirty nine poems collected by Saemund the Wise (1056–1133), eleven of which, embodying the system of mythology, are minutely analyzed in the volume. The Younger Edda was written by Snorre Sturleson, the author of the *Heimskringla* (1178–1241). In addition to these it is necessary to study all the Icelandic Sagas, the Anglo-Saxon Boewulf's *Drapa*, and the Niebelungen Lied.

The gods and goddesses (*æsir* and *ásynja*) dwelling in Asgard are Odin (chief of the gods), Thor (god of thunder and keeper of the hammer), Balder (summer-sunlight), Tyr (Zeus, the one-armed god of war), Brage (god of poetry), Heimdal (the heavenly watchman), Hoder (the Norse Cain), Vidar (slayer of the Fenris wolf), Vale (brother of Balder), Uller, Forsete (the peacemaker), and Loke (the evil giant-god). The goddesses are twenty-six in number. Odin's hall is the great Valhal. The tree Ygdrasil, striking its roots through all worlds, spreading its life-giving arms through the heavens, and furnishing bodies for mankind from its branches is beautifully described (188, and 205). The second part of the volume, 215–409, constitutes a perfect classical dictionary of Norse mythology, adding to its richness of detail the enthusiasm of intense sympathy.

The final destruction of the world, and regeneration of gods and men, is called Ragnarak. This theoktonic myth is wanting in Greek mythology. Ragnarak is an outbreak of all the chaotic powers, a conflict between them and the established order of creation.

The student of comparative mythology, upon taking a work of this class in his hand, almost instinctively asks what the author will do with his body of myths. It is possible to run any theory to extremes and to say some very silly things, as Tylor and Baring Gould have shown us. Here is the point where the sympathetic reader trembles for his author. Professor Anderson, while taking the nature view of Norse mythology, handles the subject with extreme caution. The myth reflects nature and society, the one inextricably in communion with the other. The harsh climate of the North modified not only the Norse mythology, but also molded indefinitely the national character, and then the two acted and reacted upon each other.

Inscribed Stones.—In No. 53 of the tracts of the Western Reserve and Northern Historical Society, dated March, 1881, Col. Charles Whittlesey exposes the spuriousness of an inscribed stone from Newark, Ohio, described and figured in the Report of the Congress of Americanists, held at Nancy, France, in 1875 (Vol. II, p. 191). The communication upon the stone was presented to the Congress by Mr. Henry Harrisse, of New York, in the name of Dr. Samuel H. Barlow, of New York, and Dr. N. Roe Bradner, of Philadelphia, dated July, 1873 The characters purport to be Hebrew letters, and the inscriptions cover the four faces of a truncated pyramid. The story of the finding of the precious relic is briefly told by Col. Whittlesey, and calls to mind a remark made by Professor Dawkins to the editor of these notes during his visit to America last autumn: "Is it not too bad," said the learned cave-hunter, "that the question of veracity should be raised at the very threshold of an important investigation, to cast a cloud of doubt over all future work. And yet we are constantly

troubled with it in England, nor are you quite free from it in America." The thanklessness of the task of showing up frauds should not deter those who are in a position to do the work effectively, should be no discouragement to those who hold the truth above all ephemeral theories.

AMERICAN PHILOSOPHICAL SOCIETY.—In the Proceedings of the Am. Philos. Soc., 1880, but four papers appear bearing at all upon our theme:

Some recent discoveries of Stone Implements in Africa and Asia, by Henry Phillips, Jr.

On Dr. Valentini's Critique of Landa's Maya Alphabet, by J. P. Lesley.

On a kitchen heap at Saltville, in Southwestern Virginia, by C. Lewis.

Note on an engraved disk from Guatemala, by Mr. Dubois.

CRUISE OF THE CORWIN IN BEHRING SEA AND THE ARCTIC OCEAN.—Document No. 118 of the Treasury Department, Nov. 1, 1880, is a Report of the cruise of the U. S. revenue steamer *Corwin*, commanded by Captain C. L. Hooper, U.S.R.M., in the Behring sea and the Arctic ocean. In addition to the customary duties of the Revenue Service and the search for missing whalers, Capt. Hooper gave a great deal of attention to ethnological research. The sad story is told of the starvation of several whole villages on St. Lawrence island, indeed over four hundred natives had died in this manner upon this one island in two years. The author attributes the great mortality to the improvidence caused by whisky. It seems rather heartless, but really, four hundred skeletons, or even crania, of this homogeneous group of people, would be a precious acquisition to any museum.

CHAVERO, ALFREDO—Historias de las Indias de Nueva España y Islas de tierra firme. Por El Padre fray Diego Duran, Religioso de la Orden de Predicadores (Escritor del Siglo, XVI). Apendice. Explicacion del Códice Geroglefico de Mr. Aubin. Por Alfredo Chavero, Secretario perpetues de la Sociedad Mexicana de Geografía y Estradística. 16 plates.

THE VICTORIA INSTITUTE.—The handsome volumes of this society have reached the fourteenth number. The following papers are valuable in our field of study: The ethnology of the Pacific, by the Rev. S. J. Whitmee, with a map showing the distribution of races and all the results of the latest discoveries; The Druids and their religion, by J. E. Howard; The evidence of the later movements of elevation and depression in the British Isles, by Professor T. Mck. Hughes; The religion and mythology of the Aryans of Northern Europe, by R. Brown.

CONGRESS OF AMERICANISTS.—The fourth meeting of the International Congress of Americanists will be held in Madrid, from Sept. 18–20, 1881, under the protection of King Alfonso XII. A neat little 16mo pamphlet of 72 pages, published by Manual G. Hernandez, of Madrid, contains full directions for those who would take part in the proceedings.

ANTHROPOLOGY OF THE EAST INDIES.—The Journal of the Royal Asiatic Society of Great Britain and Ireland was founded in 1823, and has been among the very foremost in fostering Oriental studies. In looking over Part I, Vol. XIII, new series, it is interesting to notice how the old standard periodicals are becoming infused with the latest subjects of anthropologic research. The number contains papers on the Indian Theistic Reformers, on the Kawi language and literature, on the Nirvana of the Northern Buddhists, and the Invention of the Indian alphabet.

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GEOLOGY AND PALÆONTOLOGY.

FOSSILS OF THE IOWA LOESS.—The loess of Iowa is, for the major part, limited to the extreme western and south-western portions of the State. The counties of Fremont and Mills are entirely, while those of Page, Pottawattamie, Harrison, Monona and Woodbury, are partially covered by this deposit. Professor Witter has discovered it under and about the city of Muscatine, on the Mississippi river, but as the following list is the result of personal observations, it will be limited to those portions studied on the western side of the State. The species all belong to either aquatic, semi-aquatic or terrestrial genera. Of the species here listed, Professor J. E. Todd has given, in the Proceedings of the American Association for 1878, some eighteen forms; and in the Report of the Geological Survey of Missouri for 1855, Professor Swallow records forty species of land and fresh-water shells, all determined by the careful hand of F. B. Meek. One hundred and twenty-three species are enumerated by Professor Samuel Aughey in his "Sketches of the Physical Geography and Geology of Nebraska," but the great majority of them could not have been properly determined, and this with all due deference to that gentleman. No more than thirty-seven, *perhaps* forty, of all the forms he has enumerated can possibly stand. Of his list, eighteen are mentioned by generic names alone, and thirty-one are given with a question. It is not a little singular that most of the forms he names have not been found by other observers in the same field; they do not occur in the lists of either Professor Todd or Professor Swallow, and my own studies of the loess fail to bring many of them to light. The loess in the three States of Nebraska, Iowa and Missouri, where the gentleman named studied the formation, was all deposited during the same period, had the same origin, and the geographical extent of its deposition is too limited, by far, to admit of such radical differences of climate that tropical and sub-tropical forms should be found on one side of the Missouri river, but fail to appear in the same formation on the opposite side.

During occasional visits to the bluffs of loess that border the Missouri in the counties of Fremont and Mills, the following species of Mollusca have been found, some of them in fair abundance when the nature of the deposit is considered, while others are of extreme rarity: *Hyalina arborea* Say, *H. indentata* Say, *H. minuscula* Binney, *Stenotrema monodon* Rack., *Helicodiscus lineatus* Anth., *Conulus fulvus* Drap., *Strobila labyrinthica* Say, *Patula alternata* Say, *P. striatella* Anth., *Mesodon clausa* Say, *M. profunda* Say, *M. multilineata* Say, *M. thyroides* Say, *M. albolabris* Say, *Vallonia pulchella* Müll., *Macrocyclis concava* Say, *Pupa pentodon* Say, *P. armifera* Say, *Succinea obliqua* Say, *S. ovalis* Say, and perhaps one or two other species of Pupa not satisfactorily determined. This list comprises all the land shells found. The

varieties belonging to the fresh-water fauna are less numerous, though they occur in perhaps greater relative abundance, *Limnæa* being the genus most numerously represented. The kinds found were *Helicina oculata* Say, *Pomatiopsis lapidaria* Say, *Limnæa humilis* Say, *L. reflexa* Say, *L. caperata* Say, *Physa heterostropha* Say, *Planorbis trivolvis* Say, *Segmentina armigera* Say, *Valvata tricarinata* Say, *Sphærium striatinum* Lam., and an occasional fragment of *Anodonta (?)*. The last has never been found in a sufficiently well preserved condition to make a sure generic classification. No remains of Unio have ever come under my notice. The nature of the sediment composing the loess, together with the habits of the genera above indicated, all of which inhabit comparatively still and shallow waters, will enable us to gain a fairly correct idea of the conditions under which the deposit was formed. These lists may do what they can to determine the origin of the loess, which, so far as their individual testimony goes, was lacustral.—*R. Ellsworth Call, Des Moines, Iowa.*

THE RODENTIA OF THE AMERICAN MIOCENE.—The following catalogue shows the affinities of the members of the order *Rodentia* found hitherto in the White river, Truckee and Loup Fork horizons of the Miocene:

SCIUROMORPHA. Squirrels.

SCIURIDÆ.

Sciurus vortmani Cope; Pal. Bull. 31, p. 1, 1879. Truckee.
Sciurus relictus Cope (Paramys); New Vertebr. Colorado, 1873, p. 3. White river.
Sciurus ballovianus Cope; Bullet. U. S. Geol. Surv. Terrs., Feb., 1881. Truckee.
Gymnoptychus minutus Cope; Pal. Bull. No. 16, p. 6, 1873. White river.
Gymnoptychus trilophus Cope; Pal. Bull., No. 16, p. 6, 1873. White river.
Meniscomys hippodus Cope; Pal. Bull., No. 30, p. 5, 1878. Truckee.
Meniscomys liolophus Cope; Rept. U. S. Geol. Surv. Terrs., IV, MS. Truckee.
Meniscomys cavatus Cope; Rept. U. S. Geol. Surv. Terrs., IV, MS. Truckee.
Meniscomys nitens Marsh; Am. Journ. Sci. Arts, 253, 1877. Truckee.

ISCHYROMYIDÆ.

Ischyromys typus Leidy; Ext. Fauna Dak., Nebr., 1869, 335. White river.

CASTORIDÆ.

Castor peninsulatus Cope, Report U. S. Geol. Surv. Terrs., IV, MS. Truckee.
Castor gradatus Cope (*Steneofiber*); Pal. Bull., 30, p. 1, 1878. Truckee.
Castor nebrascensis Leidy (*Steneofiber*); Ext. Mamm. Dak., Nebr., 1869, p. 338. White river.
Castor pansus Cope; Report U. S. Expl. Surv. W. of 100 Mer., IV, p. 297, 1877. Loup Fork.
Eucastor tortus Leidy; Ext. Mamm. Dak., Nebr., 1869, p. 341. Loup Fork.

MYLAGAULIDÆ.

Mylagaulus sesquipedalis Cope; Bull. U. S. Geol. Surv. Terrs. 1873, p. 384. Loup Fork.
Mylagaulus monodon Cope; Rept. U. S. Geol. Surv., IV, MS. Loup Fork.

? FAM.

Heliscomys vetus Cope; Synopsis New Vert., Colorado, 1873, p. 3. White river.

MYOMORPHA. Mice, etc.

MURIDÆ.

Eumys elegans Leidy; Ext. Mamm. Dak., Nebr., 1869, p. 342. White river.
Hesperomys nematodon Cope; Pal. Bull., No. 31, p. 1, 1879. Truckee.

Hesperomys loxodon Cope; Report U. S. Expl. Surv. W. of 100th Mer., IV, p. 300. Loup Fork.
Paciculus insolitus Cope; Pal. Bull., No. 31, p. 2, 1879. Truckee.
Paciculus lockingtonianus Cope; Bull. U. S. Geol. Surv. Terrs., 1881, p. 176. Truckee.

GEOMYIDÆ.

Entoptychus planifrons Cope; Pal. Bull., No. 30, p. 3, 1878. Truckee.
Entoptychus lambdoideus Cope; Report U. S. Geol. Survey, Terrs., IV, MS. Truckee.
Entoptychus minor Cope; Report U. S. Geol. Surv. Terrs., IV, MS. Truckee.
Entoptychus cavifrons Cope; Pal. Bull., No. 30, p. 2, 1878. Truckee.
Entoptychus crassiramis Cope; Pal. Bull., No. 30, p. 3, 1878. Truckee.
Pleurolicus sulcifrons Cope; Pal. Bull., No. 30, p. 4, 1878. Truckee.
Pleurolicus leptophrys Cope; Report U. S. Geol. Surv. Terrs., IV, MS. Truckee.
Pleurolicus diplophysus Cope; Report U. S. Geol. Surv. Terrs., IV, MS. Truckee.

HYSTRICOMORPHA.

HYSTRICIDÆ.

Hystrix venustus Leidy; Ext. Mamm. Dak., Nebr., 1869, p. 343. Loup Fork.

LAGOMORPHA. Rabbits.

LEPORIDÆ.

Panolax sanctæfidæi Cope; Report U. S. Expl. Surv. W. of 100th Mer., IV, p. 296. Loup Fork.
Palæolagus agapetillus Cope; Pal. Bull., No. 15, p. 1, 1873. White river.
Palæolagus haydeni Leidy; Ext. Mamm. Dak., Nebr., 1869, p. 331. Truckee and White river.
Palæolagus turgidus Cope; Pal. Bull. No. 16, p. 14, 1873. White river.
Palæolagus triplex Cope; Pal. Bull., No. 16, p. 14, 1873. White river.
Lepus ennisianus Cope; Report U. S. Geol. Surv. Terrs., IV, MS. Truckee.

SUMMARY.

	Genera.	Species.
Sciuromorpha	8	17
Myomorpha	5	13
Hystricomorpha	1	1
Lagomorpha	3	6
	17	37

—*E. D. Cope.*

A NEW CLIDASTES FROM NEW JERSEY.—Professor Samuel Lockwood, of Rutgers College, recently discovered part of the skeleton of a large Mosasauroid reptile near Freehold, Monmouth county, New Jersey, which he sent me for examination. It proves to be a *Clidastes*, and much larger than any of the species of the genus hitherto known, having the dimensions of the *Liodon validus*. The parts preserved include numerous vertebræ, the greater part of the lower jaw with some teeth; a humerus and ulna nearly perfect; a nearly entire coracoid, and parts of both scapulæ. Besides the zygosphene articulation, the species displays other points of resemblance to the known species of *Clidastes*, as the narrow articular surfaces of the lateral joint of the lower jaw, the slender dentary bone and the very robust humerus. The extremity of the dentary bone is broken off. There are sixteen teeth and alveolæ on the portion preserved, and there were probably two or three others on the lost portion. The

teeth differ from those of the known species in their subcircular instead of lenticular section. The middle teeth have fore and aft cutting edges, and are not faceted. The anterior teeth have no posterior cutting edge, and resemble in form those of *Platecarpus*. The enamel in all is smooth. The coracoid has a deep fissure extending towards the foramen. The humerus is wider distally than it is long. There are eight cervical vertebræ preserved, including the atlas and axis. The articular faces of the centra of these are a little wider than deep, and subcordate in form. The articular surfaces of the dorsals are relatively a little deeper, but are distinctly depressed. A distal caudal is also wider than deep, and of subquadrate outline. The chevron bones are coössified.

Probable length of dentary bone m. .620; depth of do, at fifth tooth from behind .077; diameters of crown of eighth tooth from behind, anteroposterior .018, transverse .016; diameters of cup of a cervical vertebræ, vertical .056, transverse, .066; do. of a dorsal, vertical .058, transverse .066. Length of humerus .130; distal width .160. Width of coracoid .225.

The species may be called *Clidastes conodon*.—*E. D. Cope.*

The International Geological Congress.—The International Geological Congress, which held its first session at Paris, in 1878, will meet again in Bologna, on the 26th September next under the presidency of M. Sella. Its success is assured by the generous liberality of the King of Italy, its protector. During the congress a geological exposition will be opened, for which important material has been sent. Professor M. Capellini of the University of Bologna, president of the committee on organization, will distribute the programme for the coming session, comprising different excursions of much interest to Imola, Poretta, Carrara, Pisa and Florence. The report of the international commission appointed in 1878 for the preparation of simplified geological nomenclature and conventional signs for the charts will also be addressed to the subscribers. The last question is open for competition, for which the king has set aside prizes awarded by jury. The memoirs for this competition must be in the hands of M. Capellini in Bologna by the 1st of June. The subscription amounts to twelve francs, and should be sent to treasurer of the Geological Society of France, 7 rue des grands-Augustins, Paris. The receipt will be forwarded immediately, and entitles the member to his ticket, to be delivered in Bologna on the 20th of September, and also to the Proceedings and other publications of the Congress.—*Revue Scientifique*,

Gaudry on Stereorhachis.—Professor Gaudry exhibited to the French Academy of Sciences, May 16, a block of the Permian of Igornay containing the bones of the Saurian named by him *Stereorhachis dominans*. It is the finest specimen of a quad-

rupedal animal yet found in a Palæozoic formation. The size of the specimens readily permits study of the curious scales formed like spines, which cover the belly in this species, the *Euchirosaurus* and the *Actinodon.* When these animals turned upon their backs, they presented these scales, and a strong entosternum and episterna, all supported by strong ribs, and were unassailable.

DILLER'S FELSITES OF THE REGION OF BOSTON.—A Geological Series of the Bulletin of the Museum of Comparative Zoölogy of Harvard University has been commenced, the second number of the volume being an essay on the felsites and the associated rocks north of Boston, by J. S. Diller.

GEOLOGICAL NEWS.—The Journal of the Geological Society of London for January, 1881, contains several articles of unusual interest. First is a paper on the structure of the spiral arms in several families of the Brachiopoda, by Thos. Davidson, which is largely based on specimens worked out very beautifully by the Rev. Norman Glass. Secondly, Descriptions of some specimens of pterodactyles of the genus *Ornithochirrus* from the Cambridge Upper Greensand, by Professor H. G. Seeley. Third, The relation of the Escharoid forms of Oölitic Polyzoa, by F. D. Longe, F.G.S. Fourth, New species of fossil fishes from the Black band iron stone near Edinburgh, by Dr. Traquair.——In the number of the Proceedings of the American Philosophical Society for January–June, 1881, Professor J. J. Stevenson gives an account of the geology of the south-western counties of Virginia. Professor Cope publishes a systematic analysis of the families and genera of the *Perissodactyla,* and of the species of *Triplopidæ;* also a note on the structure of the hind foot of *Toxodon,* which he finds to refer the *Toxodontidæ* near to or among the *Proboscidea.*—— Miss Agnes Crane, of Brighton, England, author of various palæontological papers, is at present traveling in this country accompanied by her father. —— Professor Weatherby, of Cincinnati, has recently discovered, in Kentucky, some huge crinoids with bodies a foot in diameter.——A specimen of *Rhinoceros (Cœlodonta) merki* was recently found imbedded in the ice of a tributary of the Lena river, Siberia. It was almost entire, with the flesh in good preservation. The head and foot only were preserved; the former is now at St. Petersburg.——Professor W. C. Kerr in the Transactions of the American Inst. of Mining Engineers describes the mode of occurrence of mica in North Carolina. It is found in irregular masses in vein-like beds of felspathic granite of very coarse texture in the Laurentian formation. The masses of felspar sometimes weigh several tons, and a single block of mica has been known to make two full two-horse wagon loads. The sheets sometimes measure three or four feet in diameter.

GEOGRAPHY AND TRAVELS.[1]

AFRICAN EXPLORATION.—The April number of the Royal Geographical Society's *Proceedings* notices an interesting report received by the London Missionary Society from their mission at Mtowa, on the western shore of Lake Tanganyika, in Northern Uguha, concerning the country and its people. Uguha is divided by the Lukuga river into two districts, northern and southern. Northern Uguha has a population of probably from 15,000 to 20,000, and the largest village is Ruanda, with from 500 to 600 houses. Mtowa, near which the missionaries have settled, is a village of the average size, containing ninety houses and some 300 inhabitants. It is enclosed by a semi-circle of hills, which start from Southern Ugoma, trend inland for some distance, and reach the lake shore at Cape Kahangwa. Beyond these hills stretches the plain of Ruanda, watered by several small streams, of which the Lugumba is the only one of importance. The domestic animals of Uguha are goats, sheep and fowls, but some of their chiefs possess pigeons obtained from Marungu or Ujiji. The only cattle are those belonging to the mission, though some are occasionally brought across the lake to be taken into the interior. There are said to be numerous wild animals in the hills to the north, among which are buffaloes, gorillas, leopards, monkeys, wild boars and antelopes, but hyenas are unknown. Good timber is not very plentiful except at some distance inland, where teak and other trees abound. Maize and millet are the only grain cultivated, though near the lake the land is in parts suitable for rice and also for the sugar-cane. Micaceous slate is found in abundance almost everywhere. The natives of Uguha are peaceable and industrious on the whole, but rather given to drink at the close of the harvest. Physically they are a fine people, men of over five feet eight inches being the rule rather than the exception. The Waguha are chiefly distinguished from their neighbors by the peculiar mode of dressing the hair and by the fact that the men chip the two front teeth and the women are profusely tattoed. There is but little, however, to distinguish them from the Warua, except a slight difference of language. Their first chief is said to have come from Ugoma and settled near Cape Kahangwa, where he was joined by people from Urua and Marungu.

As regards clothing, the women wear two or three pieces of fiber cloth dyed in two colors, while the men wear one large piece tucked under the belt, some also using the skins of monkeys and other animals, as well as foreign cloth.

Kasanga, of Ruanda, is said to be chief of all Uguha, but he in his turn is subject to some one else. In the villages regard is had to precedence in the arrangement of the houses, the *Walingwena*, or slaves, living in one part and the *Wabangi*, or freemen, in another.

[1] Edited by ELLIS H. YARNALL, Philadelphia.

The latter have elders, or *Watwita*, who represent them in the council of the elders.

On the outside the houses appear like beehives, but the inside walls are perpendicular and some four feet high. From these walls springs the roof, the center of which is ten or twelve feet from the ground, but there is no center post, and the rafters are simply fastened by rings of cane from the center downwards. On the outside, grass is laid very thickly and made to reach the ground. The interior is kept scrupulously clean by the women, and order appears to prevail in the arrangement of everything.

The trade of the country consists chiefly of ivory from Urua, Ubudjwe and other districts and in home-grown corn. Of late years the men have shown a disposition to travel, visiting Unyanyembe and even Bagamoyo and Zanzibar, Some go as porters in Arab caravans and others on ventures of their own.

Further interesting details are given concerning the domestic life, musical instruments, modes of burial and religious notions of the Waguha.

At the meeting of the Berlin Geographical Society, held on March 5, 1881, it was announced that several letters had been received from Dr. E. Junker, who at the commencement of last year undertook at his own expense a second voyage to Africa, for the purpose of exploring those portions of Central Africa first made known to us by the travels of Dr. Schweinfurth. The most recent of these letters was dated from the Monbuttu country, September 1, 1880. After a lengthened sojourn at Meschera-el-Rek, on the banks of the Bahr-el-Gazal, Dr. Junker had penetrated in a south-west direction through the land of the Bougo or Dohr negroes into the territory of the Niam Niam, by the inhabitants of which, falsely described as anthropophagi, he was received in a most hospitable manner. In the settlement of the chief, Ndoruma, he built himself a hut supplied with every comfort, and here, in the enjoyment of perfect repose, he worked out the reports of his journey, which have already reached home. Thence, in the month of August, he proceeded in a south-west direction into the territory of Pulembata, and afterwards in a south-south-east direction into the country of the Monbuttu. His letter of the first of September, above mentioned, was dated from the limits of the territory of the Mangballa, a day's journey north of the Welle. The traveler proposes to cross the Welle and to visit the Mombanga, a tribe of Monbuttu, and finally to penetrate in a north-west direction amongst the A-Madi. All these territories are as yet unexplored, as they are situated to the westward of Dr. Schweinfurth's track, and there was reason to hope that the traveler, whose state of health was perfect, would successfully carry out his intentions.

On April 1st the French Geographical Society gave a reception to Dr. Lenz, on his return from Timbuktu. The successful traveler gave some interesting details on the present condition of Timbuktu. Its houses are built of brick, and the population is now only 20,000. It has greatly decayed, and the inhabited part of the town is surrounded by great spaces covered with ruins. There are numerous schools and rich libraries. Dr. Lenz had a cordial reception, and every night during his twenty days' stay he was present at religious conferences which the learned men of the city held with his interpreter. The commentaries on the Koran formed the only subject of conversation. Timbuktu is united with the Niger three miles off by a series of lakes formerly canals. Dr. Lenz has also made some interesting observations on the Sahara, tending to confirm the conclusions of Rohlfs and other recent scientific travelers, as to the variety which is to be met with in the great desert. It is really a plateau about 300 meters in altitude, no part of it being below the level of the sea. Granite hills, sandy plains, shallow lakes, fertile oases alternate over nearly the whole surface, while beasts of prey are rarely to be met with. Dr. Lenz does not advocate the construction of a railroad from the Niger to Algeria.

No fewer than seven different languages are spoken on one side of Lake Nyassa, which is only 350 miles in length, and natives from the southern end cannot understand those at the northern.

The Algerian missionary expedition has established a station in Urundi at the head of Lake Tanganyika. It is a country whose physical features are strongly marked, a chain of treeless mountains traversing it from north to south. The population is numerous, but very timid. They appear to be agricultural in their habits, manioc, bananas, beans, etc., being largely cultivated.

Although there are some marshes, Urundi is reported to be healthier than Ujiji, an additional recommendation being the entire absence of Arabs. The Wabikari, who live near where the missionaries are settled, have shown themselves well disposed, though they have the reputation of being thieves and enemies to all strangers. They were anxious for the party to settle among them on their arrival, but, the Bikari district lying low, it was thought wiser to occupy the right bank of the Murembué, which appeared a healthier site.

After the completion of seventy or eighty miles, the road from Dar-es-Salaam to Lake Nyassa has been temporarily discontinued. Its superintendent is now employed by the Sultan of Zanzibar exploring the neighboring region. This road has already had an excellent, even marvelous, effect upon the

natives. Dr. Kirk, of Zanzibar, has recently passed over it for some forty miles in company with a naval officer. He reports that it is now quite safe for unarmed travelers, although but two or three years ago no one would have ventured in the neighborhood without a large escort.

The *Academy* states that "one of the objects of Mr. Jas. Stewart's late visit to the head of Lake Nyassa was to ascertain how far the Kambwe lagoon could be made available as a harbor for the missionary steamer from Livingstonia. During his investigations he made a curious discovery with regard to the River Rukuru, which until about two years ago flowed through the lagoon. He found that this river had changed its course, and that its former bed had silted up and is now even higher than the surrounding ground. This unusual occurrence he accounts for in the following way: During the rainy season the country is under water for miles, so the Rukuru flowed in a course marked by reeds and had for its banks the standing water of its own overflow. The heavy sand was rolled down the channel from the higher ground and deposited over its whole length until it was raised to such a height that the current was forced into another channel. In further explanation it should be mentioned that the Rukuru, in the last fifteen miles of its course, winds through precipitous valleys and falls upwards of 2000 feet, washing far into the lake large quantities of blueish-gray silt."

A road between Lake Nyassa and Tanganyika is projected.

The *Athenæum* states that "two important maps bearing upon the geography of Africa have been published in the *Mittheilungen*. The first exhibits the preliminary results of Herr Clemens Denhardt's explorations of the Tana River, which that explorer ascended and carefully surveyed almost to the foot of the eastern buttresses of snow-clad Kenia. Herr Denhardt found the river to be navigable throughout, and as its banks are inhabited by peaceable Wapokomo and Galla, he considers it to present many advantages for penetrating to Mount Kenia or to Lake Zamburu, in the Galla country to the north. We, therefore, direct the attention of intending explorers to this locality, for hardly anywhere else in Africa can substantial discoveries of equal interest be accomplished within so short a distance from the coast. The second map, almost equally important, exhibits Dr. Junker's journey up the Khor Baraka, from its mouth to the south of Suakin, as far as Belagenda. Herr Hasentine, the compiler of this map, has embodied in it all the information available with respect to the country it embraces."

GEOGRAPHICAL NEWS.—Two English engineers, Lieutenants Conder and Mantell, are about to commence the survey of Eastern Palestine. It is estimated that the work will take five years to accomplish.——Mr. Leigh Smith expects to pay another visit to Franz-Josef Land this summer.——In an appendix to Captain

Markham's "Polar Reconnaisance," Sir Joseph Hooker, in treating of the botanical specimens collected in this voyage to Novaya Zemlya observes: "Comparing, then, the floras of the three high Arctic meridians of Novaya Zemlya, lat. 70°–77°, long. E. 60°; Spitzbergen, lat. 76½°–80½°, long. E. 20°; West Greenland and Smith's Sound, &c., lat. 71°–82°, long., W. 60°–70°, we find that they present great differences, Greenland being the most remarkable: 1. From the number of species of European types it contains which there reach so very high a parallel. 2. From differing more in its flora from Spitzbergen and Novaya Zemlya than these do from one another; and, 3, From the absence of Arctic *Leguminosæ*, *Caltha* and various other plants that extend elsewhere around the Arctic circle. These facts favor the conclusion which I have expressed in the Appendix to Sir George Nare's Narrative (II, 307), that the distribution of plants in the Arctic regions has been meridional, and that their subsequent spread eastward and westward has not been sufficient to obliterate the evidence of this prior direction of migration. To this conclusion I would now add that whereas there is no difficulty in assuming that Novaya Zemlya and the American Polar Islands have been peopled with plants by migration from the south, no such assumption will explain the European character of the Greenland, and especially the high Northern Greenland vegetation, the main features of which favor the supposition that it retains many plants which arrived from Europe by a route that crossed the Polar area itself when that area was under geographical and climatal conditions which no longer obtain."——In a lecture delivered recently before the Society of Arts, in London, by Mr. Edward Whymper on Chimborazo and Cotopaxi, he dwelt at some length on the sickness experienced when at great elevations, the result of the diminution in the atmospheric pressure. He found the distress mitigated by doses of ten grains of chlorate of potash every two or three hours. After suffering for several days on Chimborazo, during which he persevered and ascended to a height of 17,400 feet, his condition improved, and finally he was restored to his normal state, so that after a residence of seventeen days on the mountain, passing the nights at heights varying from 14,400 to 17,300, all trace of mountain sickness had disappeared.——Lieutenant Karl Weyprecht, the discoverer, with Lieutenant Payer, of Franz-Josef Land, died on March 29th, at the age of forty-three. ——The Bremen Geographical Society propose to send an exploring expedition to the Tchuktche Peninsula, Northern Siberia.——At a recent meeting of the Paris Geographical Society, M. Dutreuil de Rhins identified Nabchu, where Colonel Prejevalsky was obliged to stop when only about 180 miles from the capital of Tibet, with Abbé Huc's Na-ptchu, about 32° 10′ N. lat., 89° 30′ long. E. from Paris.——The winter of 1880–81, so remarkable for its severity in America and Europe, was one of unusual mildness in Siberia.

MICROSCOPY.[1]

RECENT AMERICAN BOOKS ON MICROSCOPY. — *Compendium of Microscopical Technology*, by Carl Seiler, M.D., pp. 130, Philadelphia, 1881.—This book, while designed as a guide for beginners, will also be of frequent use to more experienced workers. It is intended as a guide for physicians and students in the use of the microscope, and in the prepartion of histological and pathological specimens for examination. Without attempting to give a comprehensive discussion of all the new or even of the most important standard methods of examination and preparation of objects, the author simply describes a few methods and expedients which he has himself fallen into the habit of using, and which he is, therefore, able to endorse as uniformly satisfactory, and to describe with that clearness, fullness and precision which should be characteristic of a working handbook. After a short and judicious chapter on the structure and use of the microscope, including a few of the most simple and indispensable accessories, practical directions are given for preparing, cutting, staining, injecting and mounting animal tissues, with separate chapters on preparation of vegetable tissues and insects, and photo-micrography. Description of the tissues themselves is omitted throughout; except that a synoptical table of the more common tumors and neoplasms is given as an appendix, which is one of the most valuable portions of the book. Two or three of the formulæ are given in the metric form, and some others in "parts," which in this case amounts to about the same thing; and the beautiful simplicity of these, and the self-evident proportion of their different constituents, gives an interesting contrast to those clumsy ones which are still given in grains, drachms, ounces and drops.

Practical Hints on the Selection and Use of the Microscope, by John Phin, editor of the *Am. Journ. of Microscopy*, pp. 231, New York, 1881.—The third edition of a book so well known as this little manual needs no commendation. Introduced six years ago as a popular handbook, of extreme simplicity, for the use of beginners, it still retains the same character, though with such extensive additions and improvements that the last edition may be considered a new book. Three quarters or more of the work are given to a description of the microscope and its various accessories, and the remaining portion to the collection and preservation of objects. The whole is characterized by its sound common sense, and its practical utility. Probably no book on the subject, really adapted to beginners and presuming so little on their previous education, contains so much of valuable and interesting information.

Handbook of Systematic Urinary Analysis, Chemical and Microscopical, for the use of Physicians, Medical Students and Clinical Assistants, by Frank M. Deems, M.D., pp. 30, N. Y., 1880.—This

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

little essay furnishes in a tabular form a synopsis of a chemical and microscopical analysis which can, by its aid, be carried out with great facility by any person accustomed to such manipulation and familiar with the appearance of the objects sought for. Such a manual should not and cannot be made to take the place of more thorough treatises on the same subject, but as an adjunct to them it is a great convenience and time-saver, alike to beginners who are lost in the multiplied details of the larger books and need a guide-book to them, and to experienced men of business whose crowded time compels them to refresh their memories in the easiest possible way.

How to See with the Microscope, by J. Edwards Smith, M.D., pp. 410, Chicago, 1880.—The most valuable portions of this work are the various suggestions in regard to the manipulation of the modern wide-angled objectives, which are scattered throughout the work, though given more particularly in the form of lessons in the latter pages of the book. It is greatly to be regretted that the really useful ideas should be buried in such a vast amount of personality and of (to say the least) irrelevant discussion.

Fresh-water Rhizopods of North America, by Joseph Leidy, M.D., 4to, pp. 324, Washington, 1879, and *Synopsis of Fresh-water Rhizopods*, compiled by Romyn Hitchcock, F.R.M.S., pp. 56, New York, 1881.—The superb work on Fresh-water Rhizopods by Professor Leidy has lately made the study of these organisms easy as well as charming. His treatise is a scholarly and dignified work, upon a class of objects hitherto studied with difficulty on account of the fragmentary and scattered character of the data that were available to students. The present work, published by the Department of the Interior as a portion of the U. S. Geological Survey of the Territories, is well printed and sumptuously illustrated, and is a credit not only to the author and to the survey of which it forms a part, but also to American science.

As Dr. Leidy's work is already becoming scarce, and will soon be unattainable, except occasionally and at high price, Professor Hitchcock has prepared a brief abstract of the subject, based upon it, and published it as stated above. Brief descriptions of the genera and species are given, with scarcely any variations from the original, except those which were made necessary by the absence of illustrative plates. It is believed that these descriptions will enable the student to name his species without the aid of figures; and that this little book will be of use even to those who possess Dr. Leidy's larger book, serving as an analytical key to that, and leading the student directly to the proper genus or species. As many will use this small book who have not access to its larger predecessor, the want of plates will be much felt, and an appendix in the form of a sheet or two of engravings of typical species would probably find ready sale among the owners of the book.

The Student's Manual of Histology, by Charles H. Stowell, M. D., pp. 279, Detroit, 1881.—This modest book is really one of the most useful of recent publications. After a brief chapter on the microscope and mounting apparatus and reagents, some twenty chapters are given upon the microscopic anatomy of the various organs of the body, with an additional chapter on tumors and one upon starches. The descriptions of the tissues are concise, pithy and clear, and abundantly illustrated by nearly two hundred woodcuts. The directions for preparing and examining the various tissues are not loaded down by a great variety of untried methods, but are confined to a few methods which are in very general use or have become favorites with the author. Altogether the book, while not competing with the large manuals for use by scholars and teachers, is a most excellent handbook for the student, whether in the study or in the laboratory. Much credit is due for the care taken to add a statement of the magnifying power to the engravings, but it is to be hoped that other authors will go still further, and that, ere long, no engraving will be considered worth copying which lacks this essential feature.

PRIZES FOR MICROSCOPICAL ESSAYS.—The Boston Society of Natural History offers a first prize of from $60 to $100 and a second of $50 for the best memoirs in English upon the following subjects: The occurrence, microscopic structure and use of North American fiber-plants; treating especially of the fibers employed by the Native Races; and original, unpublished investigations respecting the life-history of any animal. Prizes for papers on the first subject will be awarded in April, 1882, and on the second subject in April, 1883, provided the papers offered are deemed of adequate merit. Further particulars can be obtained from Edward Burgess, secretary of the society.

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SCIENTIFIC NEWS.

— Dr. J. J. Bigsby, well known as a writer on the geology of British America, and author of Thesaurus Siluricus, and founder of the "Bigsby Medal," died in London, Feb. 10, 1881. The death of Dr. Barnard Davis, the distinguished craniologist, occurred at Hanley, England, late in May. He was joint author with Thurnam of "Crania Brittanica." His collection of skulls, said to be the largest in existence, has recently been purchased by the Royal College of Surgeons. Another loss to English science was the death, early in April, of Sir Philip Egerton, one of the highest authorities on fossil fishes. M. Delesse, a distinguished French geologist, died in Paris in March, aged 63.

— Book of the Black Bass, by James A. Henshall, M.D., is announced to be published by the author by subscription, 33 Wesley avenue, Cincinnati, Ohio.

— The municipality of Marseilles has granted a subsidy towards the laboratory of marine zoölogy proposed to be established on the Gulf of Lyons. In this connection appears in the *Academy* the statement that a dredging excursion in the Australian seas, organized in connection with the Sidney Museum, has made extensive collections of marine life.

— The thirtieth meeting of the American Association for the Advancement of Science will begin at Cincinnati at 10 o'clock Aug. 17th. It is expected that this meeting will be the largest and most important ever held in the West. The headquarters of the Association will be at Music Hall.

— The reptiles and fishes of Australia have been made known, largely through the efforts of Mr. Gerard Krefft, who was the curator of the Sidney museum. His death in February last at the age of fifty-one, has been announced in *Nature*.

— The dinner of the New York Ichthyophagous Club took place at Glenn's island (off New Rochelle, N. Y.), on May 27th. The *menu* was as follows:

Little Neck clams. Sauterne.
Potages.
Consommé of Mossbunker.
Bisque of Razor clams. Amontillado.
Hors d'œuvre.
Boudins of Graysnapper à la Blackford.
Horseshoe crabs à la diable.
Sardines. Anchovies.
Relevés.
Drum à la Cope. Filet de bœuf à la Richelieu.
Pommes duchesse. St. Emilion.
Entrées.
Raie au beurre noir.
Sheepshead à la Normande.
Sauté of shark, Chinese style.
Squid à la Starin.
Pain de menhaden à la Goode.
Asperges. Niersteiner.
Sorbet des Princes.
Rôti.
Striped bass à la Mather. Pommery.
Gibier.
Hell-benders, Sea robins, Angle-worms,
Pieces Froides.
Lophius à la Baird. Sturgeon à l'Ichthyophage.
Salade.
Sea Weed.
Dessert.
Glaces nautiques, Petits fours, Fruits,
Fromages, Café.
Liqueurs.

The object of the society is to test and introduce to notice articles of food, derived from fresh and salt water, whose merits are generally unknown to American scientists and epicures. On the occasion in question considerable progress was made in this direction, while the guests were entertained by humorous speeches

and music. The following programme for the band was presented:

The Torpedo and the Whale .....Audran.
Marchande de Marée.....Lecocq.
One day I caught a Fish.....Planquette.

One of the editors of the NATURALIST who was present and enjoyed the occasion, makes the following report on the merits of some of the more novel dishes.

Bisque of razor clams *(Solen)*, very delicate.

Consommé of Mossbunker *(Brevurtia menhaden)*, strong and oily.

Horse-shoe crabs *(Limulus polyphemus)*, good, equal to the best devilled crabs.

Drum *(Pogonias chromis)*, very flat.

Raie au beurre noir *(Raja)*, tender but tasteless.

Sauté of shark steaks (man-eater, *Eulamia milberti*, said to have recently eaten a negro), tender and with good flavor.

Squid a la Starin *(Loligo* sp.), rather tasteless.

Hellbenders *(Protonopsis horrida)* (to be now called in deference to the new revision N. T., hades-benders), good, much like frogs' hind legs.

Beyond this the editor did not extend his researches. He desires to express his acknowledgment to Messrs. John Foord, president, and Eugene Blackford, of the committee of arrangements, for especial favors.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BOSTON SOCIETY OF NATURAL HISTORY, May 4.—Annual meeting. The annual reports of the curator, secretary and treasurer were presented, and the officers for 1881-2, elected. Dr. H. P. Bowditch spoke of the distribution of the papillæ on the skin, and Dr. C. S. Minot remarked on the young stages of the embryo chick, both subjects being illustrated by lantern projections.

May 18.—Dr. M. E. Wadsworth remarked on a microscopic examination of the Iron ore (Peridotite) of Iron Mine Hill, Cumberland, Rhode Island; Mr. F. W. Putnam gave an account of his recent archæological explorations in the Little Miami valley in Southern Ohio; Professor E. S. Morse spoke of the agricultural implements of Japan; and Mr. W. W. Dodge gave a few details of local geology.

NEW YORK ACADEMY OF SCIENCES, May 30.—Mr. A. A. Julien read a paper on the identification of the so-called "porphyry" connected with western lodes; Professor J. S. Newberry remarked on the relations of the Cretaceous rocks of North America to those of the old world.

AMERICAN GEOGRAPHICAL SOCIETY, May 10.—Mr. J. Douglas, Jr., read a paper on Chili; its geography, people and institutions.

APPALACHIAN MOUNTAIN CLUB, May 21.—An excursion of the members was made to Doublet hill, Weston, and one to Mt. Greylock *via* the Hoosac Tunnel, was projected for June 17th. At the meeting held June 8th, Mr. H. Murdock read a paper on the region surrounding the Smith's River valley, N. H., and Mr. S. H. Woodbridge gave a description of the scenery about Williamstown, Mass.

TROY SCIENTIFIC ASSOCIATION, Feb. 21.—Dr. R. H. Ward read a paper on the recent teachings of the microscope in regard to different kinds of blood.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

ANNALS AND MAGAZINE OF NATURAL HISTORY. January.—Spolia Atlantica; contributions to the knowledge of the changes of form in fishes during their growth and development, especially in the pelagic fishes of the Atlantic, by C. F. Lütken.

ANNALS AND MAGAZINE OF NATURAL HISTORY.—April. General considerations upon the carcinological fauna of great depths in the Carribean sea and Gulf of Mexico, by A. Milne-Edwards.

AMERICAN JOURNAL OF SCIENCE, June.—Geological relations of the Limestone belts of Westchester county, New York, Southern Westchester county and Northern New York island, by J. D. Dana. Fossil fishes from the Devonian rocks of Scaumenac bay, Province of Quebec, by J. F. Whiteaves. New Jurassic mammals, by O. C. Marsh.

CANADIAN NATURALIST.—April 30. Palæontological notes, by J. W. Dawson. Notes on the geology of the Peace River region, by G. M. Dawson. On the glacial phenomena of the Bay Chaleur region, by R. Chalmers.

ZEITSCHRIFT FÜR WISSENSCHAFTLICHE ZOOLOGIE.—April 22. The organ of smell and the nervous system of mollusks, by J. W. Spengel. (The olfactory organ is composed of a pair of olfactory ganglia united with an epithelial organ of hearing, the entire apparatus connected by commissures with the visceral ganglia). Process of self-division in *Euglypha alveolata*, by A. Gruber. The developmental history of the Amphipoda, by B. Ulianin (with an exquisite colored plate). On molluscan eyes of an embryonic type, by P. Fraisse. The white of the egg-gland of Amphibia and birds, by P. A. Loos.

GEOLOGICAL MAGAZINE. May.—The mammoth in Europe, by H. H. Howorth; glaciation of the Shetland, by D. Milne Home; Geology of British Columbia, by G. M. Dawson.

ERRATA.—P. 363, line 19, for *Macerna* read *Macoma*. P. 365 line 21, for Japanese parts read Japanese ports.